THE IMPACT OF AIRCRAFT NOISE ON RESIDENTIAL PROPERTY VALUES AROUND EROS AIRPORT IN WINDHOEK, NAMIBIA.

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Thesis submitted in partial fulfilment of the requirements for the degree in Master Technologiae - Environmental Management
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DECLARATION

By submitting this thesis, I, Selma Nangombe Iipinge, hereby declare that this study is the reflection of my own independent work and it has not recently been submitted for scholarly assessment towards any capability. Besides, it is my very own opinion and not those of the Cape Peninsula University of Technology.

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ABSTRACT

Many countries worldwide developed regulations, policies and put together measures to deal with the impact of aircraft noise on the neighbourhood surrounding airports. However, some measures could not be accepted by the community affected by aircraft noise because are ineffective.

Aircraft noise can be viewed as a special, social, economic and environmental issue particularly in developing nations, such as Namibia. Aircraft noise has a negative impact on residential property value close to airports. As such, has social negative effects on normal daily activities such as disturbance of radio and television signals, educational activities, recreational and other family activities.

This study focused on the effects of aircraft noise on property values as well as suggested mitigation strategies to minimise the negative effects on residential property values in Academia, Pioneerspark and Olympia, Windhoek, Namibia situated nearby Eros Airport. The aim of this study was therefore to assess the impact of noise emitted from aircraft on residential property in these suburbs in order to determine the effects of aircraft noise on recreational activities and to identify the best possible interventions to minimise the negative impact of the aircraft noise on the residential areas near the airport.

Research data was collected utilizing both qualitative and quantitative methods. The methods were adopted focusing on residents of three Windhoek suburbs adjacent to the Eros Airport (Academia, Pionierspark and Olympia), real estate agents, officials from the Namibia Airports Company (NAC) and Property Valuation Namibia (PVN).

Results showed that, aircraft noise has negative effects on individuals residing close to the airport, which then decrease the value of residential properties around the Eros airport as people try to move to quieter places. Comparing the value of residential properties from the studied suburbs, houses in Olympia had the highest value, followed by Pionierspark and then Academia. Additionally, results revealed that homeowners in Academia sold their residential properties more frequently than in other suburbs and tended to relocate to other suburbs far from the airport, while, such relocation was also associated with the education level of the residents. The perception of the residents closed to the Eros airport were found not to affect the house sale price albeit noise protection was not enlisted as a nuisance the time the residential property was sold, nor a discount was given to the buyers because of noise pollution from the airport.

Additionally, the study discovered that aircraft noise did not affect the houses' structures, but it was a source of annoyance due to disturbance of sleep, rest, and relaxation as well as interfering with sporting activities. However, PVN assessment on average residential property values of the three suburbs (Academia, Pionierspark and Olympia) from 2011 to 2015, revealed a minimal relationship between property values and noise pollution from aircraft activities from the Eros Airport. The company believes that, the value of residential properties is influenced by architectural design, quality of material used and size of the house than environmental issues such as noise pollution attributed to the nearby airport activities.

Despite these findings, the study results can play a crucial role in addressing the effect of aircraft noise on residential property value around Eros Airport in Windhoek, Namibia. In addition, the findings are of value to scholars in the field of environmental sciences generally and, particularly those who are interested in noise pollution (i.e. aircraft noise mitigation and adaptation) while, possible interventions to minimise the negative impact were suggested.

Keywords: Airport Noise Pollution, Eros Airport Namibia, Property values, Social activity disturbance

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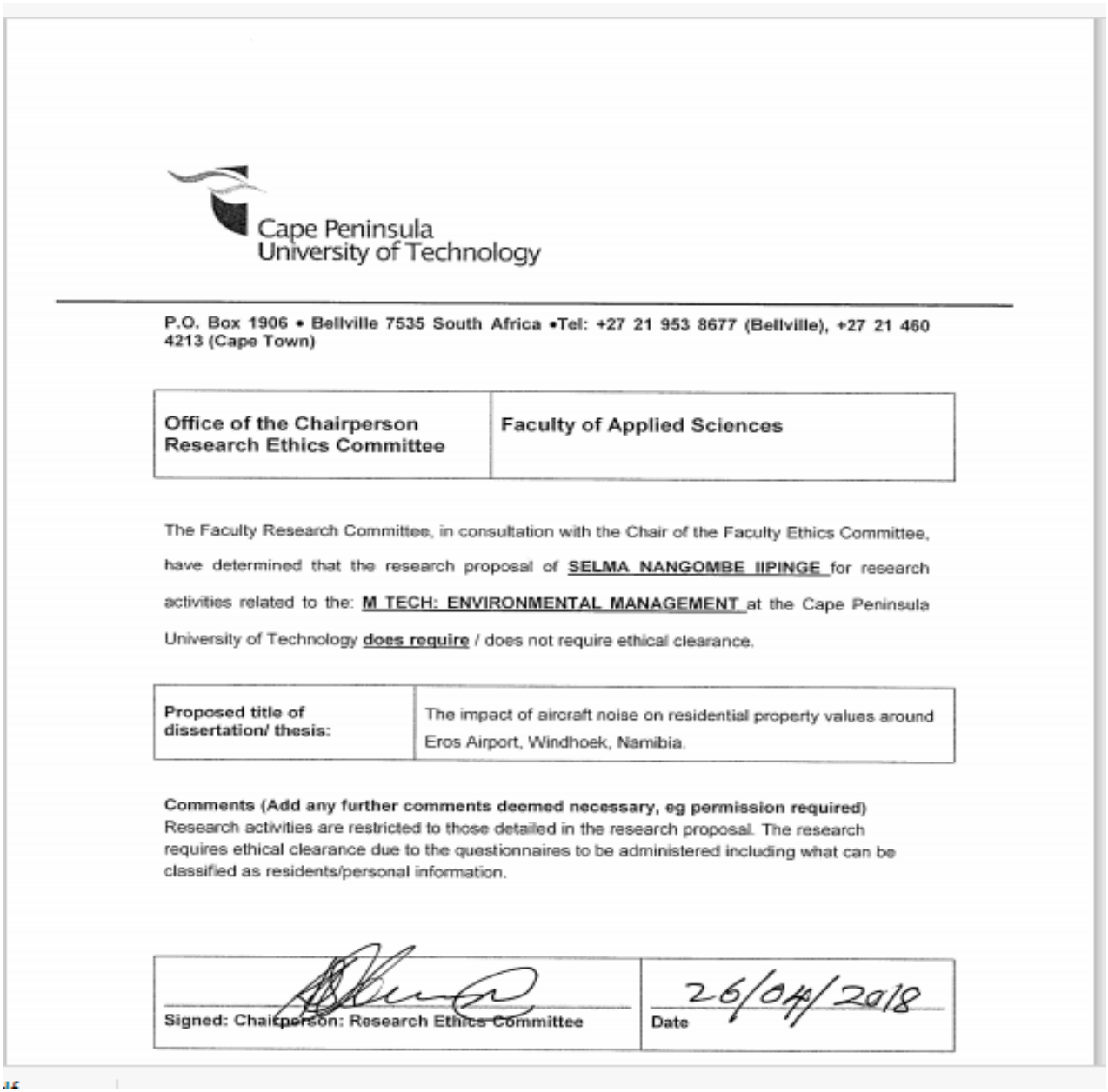

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The Faculty Research Committee, in consultation with the Chair of the Faculty Ethics Committee, have determined that the research proposal of **SELMA NANGOMBE IIPINGE** for research activities related to the: **M TECH: ENVIRONMENTAL MANAGEMENT** at the Cape Peninsula University of Technology **does require** / does not require ethical clearance.

Proposed title of dissertation/ thesis:	The impact of aircraft noise on residential property values around Eros Airport, Windhoek, Namibia.

Comments (Add any further comments deemed necessary, eg permission required)
Research activities are restricted to those detailed in the research proposal. The research requires ethical clearance due to the questionnaires to be administered including what can be classified as residents/personal information.

Signed: Chairperson: Research Ethics Committee	Date 26/04/2018

RESEARCH TITLE

The Impact of Aircraft Noise on Residential Property Values around Eros Airport in Windhoek, Namibia

CLASSIFICATION OF BASIC TERMS AND KEY CONCEPTS

Term	Definition
Impact	Positive or negative effect of an activity
Hedonic price method	A method of utilizing data from the market cost of close substitutes to drive value for good environmental services
Aircraft noise	Displeasing or unwanted sound generated by an aircraft that may be a nuisance or may disrupt the activities around the airport
Residential property	It is property used for non-business purposes consisting of homes, apartments, townhouses and condominiums
Residential property value	Assessed estimation of a private property

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LIST OF ACRONYMS AND ABBREVIATIONS

ACRP	Airport Cooperative Research Programme
AOT	Airports of Thailand
CBD	Central Business District
CPUT	Cape Peninsula University of Technology
CSR	Corporate Social Responsibility
HDC	Higher Degrees Committee
NAC	Namibia Airports Company
PVN	Property Valuation Namibia
SERC	Spatial Economics Research Centre
SPSS	Statistical Package for the Social Sciences
USA	United States of America

CHAPTER ONE: INTRODUCTION

1.1 Introduction and Research Problem

Operating an airport in the vicinity of a residential area is bound to have an impact on the immediate environment in general and on the value of the residential properties around the airport in particular. The impact of airport operations on residential property values is one of the elements of the impact of an airport on its surrounding territory, which by implication influences the local residents instead of direct airport users. Aircrafts produce noise, which causes discomfort to the residents living in areas around the airport. Exposure to aircraft noise can cause civic irritation, disturb rest, unfavourably influence scholastic performance of school going youngsters. A long-term exposure to such noise can also contribute to circulatory sickness (Basner, *et al.*, 2017). A study conducted by Nelson (2004:1) in Canada and the United States of America (USA) on the environmental effects of aircrafts noise, revealed that such effects are linked to irritation, learning difficulties, and sleeping problems.

Whitelegg (2000); Suksmith & Nitivattananon (2015), concurred that, aircraft noise is an environmental problem that may decrease the residential property values around airports. Most studies conducted by Whitelegg (2000) and Nelson (2004) concentrated on the effect of aircraft noise at major international airports globally (Espey & Lopez, 2000). These effects are reflected in the change on residential property values because of airports activities. Therefore, such changes (impacts) may be both positive (increase of house prices) and negative (decrease of house prices) as illustrated in Figure 1 (Huderek-Gapska & Trojaneck, 2013). The negative outer impacts are the effect of the aircrafts utilizing airports' infrastructures instead of the airport's activities.

Existing scholarly works on the impact of aircraft noise on property value focused on commercial airports, thus little is known on small and medium sized aviation airports. This scenario is not different in Namibia, as no studies have been done on the effect of aircraft noise on the private properties surrounding airports. It is, therefore, essential to assess the effect of aircraft noise on value of the residential properties surrounding the small airports such as Eros Airport in Windhoek, Namibia. Thus, the aim of this study is to investigate the effect of noise pollution from the Eros Airport on the neighbouring residential property values.

Eros Airport is the second largest airport in Namibia, the largest being Windhoek's Hosea Kutako International Airport. Eros Airport was built within edge of the city of Windhoek in the 1950s. The open areas surrounding Eros Airport were transformed into formal residential areas. Therefore, the airport is

now surrounded by residential properties due to residence development. Amongst these residential areas surrounding the Eros Airport are the suburbs of Academia and Pionerspark including Olympia, which are potentially exposed to aircraft noise during take off and landing of aircrafts.

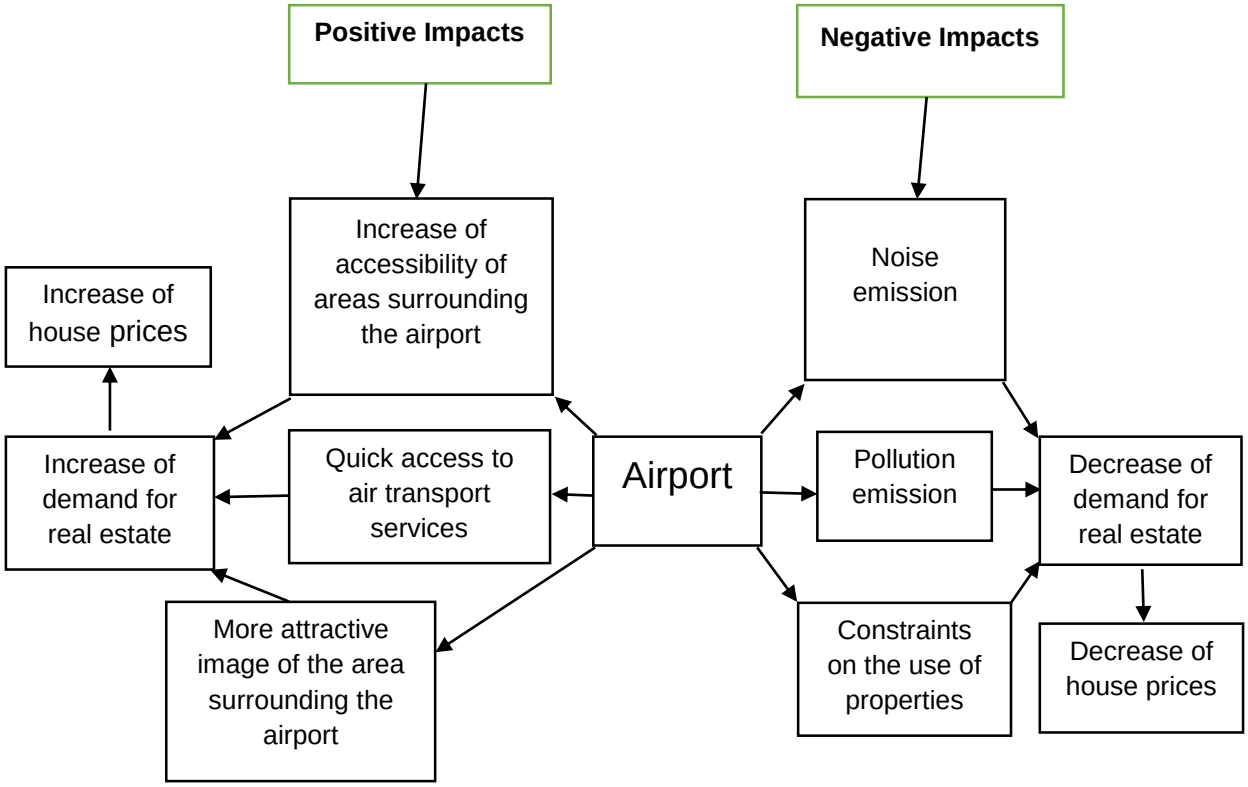

Figure 1. 1 Positive and negative impact of an airport on house costs (Huderek-Gapska & Trojaneck, 2013: 397).

As illustrated by Figure 1.1 above, the introduction of an airport is bound to result in both positive and negative consequences. An airport can result in an increase of the price of houses and increase of demand for real estate. This is a direct result on accessibility of the surrounding areas, increased access to air transport services and improved image of the area surrounding the airport. On the other hand, the location of an airport in close proximity to a residential area, is likely to result in constraints in the use of residential properties, noise and air pollution.

1.2 Research Context and Background

Aircraft noise has no civil or societal boundaries because it affects both developed and developing countries. In the beginning of civil aviation, aircraft noise was dominated by jet noise and it only became a problem after the Second World War (Huang & Zhang, 2010). The disturbance brought about by aircraft noise was known worldwide during the 1950s with the presentation of stream air transport into

common aeronautics (Cidell & Adams, 2001). A jet aircraft is one of the most intense noise delivering machines with the greatest degrees of noise experienced during touchdown, take-off or running its motors on the ground (Suksmith and Nitivattananon, 2015:58). It has been reported that the aircraft take off necessitates a higher engine push in comparison to the dominant fan noise, which is within the human range of hearing (Huo *et al.,* 2014). However, aircraft noise is generated from four sources namely, the propeller, aerodynamics, engine exhaust and engine vibration (Huo *et al.*, 2014:1; Suksmit & Nitivattananon, 2015). Overall, aircraft causes noise pollution, which has become an increasing societal, financial and environmental issue in developing countries (Van der Merwe & Von Holdt, 2005).

Worldwide, several studies on the impact of aircraft noise on humans, as well as on the surrounding residential properties and their environment, have been conducted. A research conducted by Huo *et al.* (2014); Aliyu *et al.* (2016), revealed that noise is created by the vibration of the object in the air while hearing organs react to aircraft noise through the development of air atoms in a delicate manner and can recognize the sound from its power and intensity. Another study by Dekkers and Van der Straaten (2009), found that aircraft noise has a tremendous negative effect on property values followed by road and rail traffic noise.

Therefore, aircraft noise is possibly a significant problem for residential properties surrounding the airport. At the conceptual level, research on aircraft noise and its impact on residential property value are also supported and discussed by scholars. Nelson (2004), states that the estimation of the financial value of quietness has generally centred around the impact of huge sound/disturbance on private property values. Furthermore, the survey done by Pennington *et al* (1990), at the Manchester International Airport points out that there is a worry that aircraft's noise diminishes the market value of residential property close to the airport. Over the past years, some studies have been conducted in other parts of the world but not in Namibia. None of the studies have scrutinized the association between airport noise and residential property values in Namibia. Thus, there is a need for a research of this nature to comprehend the impacts of aircraft noise at Namibia's Eros Airport on surrounding residential properties.

1.3 Study Area

According to the NAC strategic plan (2014-17), Eros Airport was Windhoek's only airport. It was initially aimed at serving both local and international travellers. The airport was initially build on the edge of the city. However, as the population grew, most residential properties and hotels such as the (Country Club and the Safari hotel) were also built near this airport. Additionally, two schools and churches were also built in those suburbs nearby (Academia, Pionierspark and Olympia) close to the

airport. As a result of the growing population, another airport (Hosea Kutako International Airport) was constructed about 50 km from the residential areas in Windhoek to serve international travellers, while Eros Airport was destined to cater mostly for domestic travellers only.

Eros Airport is Windhoek's second-most prominent airport after the Hosea Kutako International Airport. It is situated in the southern part of Windhoek, west of the main B1 Rehoboth road, which is about 500 m from the Safari hotel. According to the NAC strategic plan (2014-17), Eros Airport is situated about 4 km away from Windhoek's Central Business District (CBD) and is Namibia's busiest airport with regard to local flights. The airport sometimes accommodates a few flights between Cape Town and Windhoek, and it is Namibia's tourism gateway. The same airport handles over 75 592 passengers and 20 167 aircraft movement annually, from business, private and booked traffic, accommodating superior performance jet aircraft to Cessna aircrafts which are regularly used aircraft for charter and fly-in safaris in Namibia (Namibia Airports Company strategic plan, 2006). Airport shuttles connect Eros Airport to Hosea Kutako International Airport and downtown Windhoek. Its reliability in fuel supply makes it the most loved stopover goal for pilots and air services employees (Namibia Airports Company, 2015). Apart from being a place to repair small aircrafts, the airport is also Namibia's nucleus for general and leisure time aeronautics. Scenic and pleasure flights can be booked from Eros Airport (Namibia Airports Company, 2015).

Numerous company using Eros Airport are; Air Namibia and Westair which have 4 x Embraer ERJ 135 engine (Namibia Airports Company, 2015). Owing to its proximity to the city, Eros Airport's principal function is limited to domestic flights such as to Ondangwa, Walvis Bay, Katima Mulilo, Rundu and many other tourist destinations across Namibia as well as Cape Town (Namibia Airports Company, 2015). The flight movements in and out of Eros Airport for Air Namibia and Westair flights take place twice or three times a day from 07:00 am to 20:00 pm. Eros airport also has many local private aircrafts using it for charter flights and fly-in safaris with flights movements (in and out) being four to five times daily. The following are also amongst the critical services available at Eros Airport: ordinary cargo, a fire station, ground handling and car rental companies. Prime, yet affordable, land for prospective developers is available for warehouses, office blocks and hangars, offering proximity to Windhoek's Central Business District (CBD).

On the Northeastern side of Eros airport, is an industrial zone while the residential areas such as Academia, Olympia and Pionierspark and schools such as Academia High School, Pionierspark Primary School, Windhoek Technical School and the University of Namibia are located on the eastern side of

the airport. On the western side of the airport, there are two luxury hotels: The Country Club and Safari Hotels, including offices.

During the South African colonial period, the Namibian Government did not permit non-Europeans to live in the same suburbs. African people and people of colour were isolated and were not allowed to own houses in the same suburbs with Europeans. African individuals and people of colour were limited to stay only in two suburbs known as Khomasdal and Katutura. Europeans owned houses and resided in beautiful suburbs such as Olympia, Klein Windhoek, Eros, Academia and Pionierspark. In modern Windhoek, more than two decades after Namibia gained its independence this residential demographic pattern still exists. However, the racial separations are blurred. The leafy suburbs are still prosperous; although they are now further, assorted and new suburbs have developed in the southern parts of the city.

All Namibians have a right to buy houses in any suburb of choice in Windhoek including Academia, Olympia and Pionierspark. Houses in these suburbs rated as being in the high-income range and are owned by affluent people of different races. Most houses in these suburbs have three to four bedrooms, a kitchen, sitting room, two bathrooms, swimming pool and a double garage. These houses mostly have big yards, one backyard flat with one bedroom, bathroom, kitchen and sitting room. Houses in Academia and Pionierspark, which are located closer to Eros Airport, are similar to other houses in Kleinkuppe and Olympia residential areas located further away from the airport and possibly with the similar property values. Figures 1.2 and 1.3 provide a geographical illustration of the area surrounding Eros Airport.

Figure 1. 2: Location of the Eros Airport (Source: Google Earth)

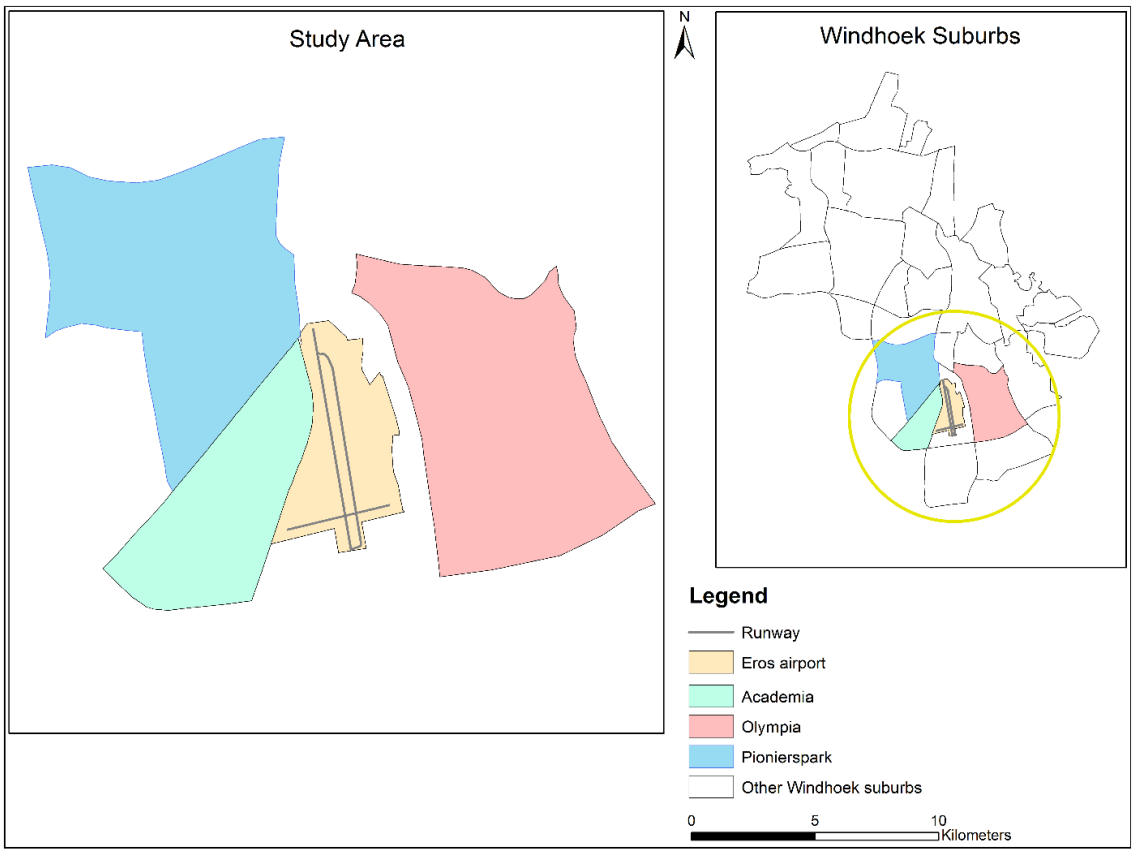

Figure 1. 3 Map of Residential areas around Eros Airport

There are many variables to consider when buying a house such as price, amenities and proximity to schools (de Araujo & Cheng, 2017). The movements of flights have obviously changed the patterns of land use close to the airports, particularly the improvement of private land, business and industrial enterprises which substantially affect property estimation in the vicinity of airports (Nelson, 2004). According to the Suksmith and Nitivattananon (2015), airport activities have a direct effect on communities living near the airport. Thus, Airports of Thailand (AOT) Public Company Limited set up a just-in-case account to repay/ recompense the residents, of a potential noise on overviewed zones impacted by airport's activities (Suksmith & Nitivattananon, 2015). According to Bell (2001), there are many impeding conditions that may affect a property's fairly estimated worth. Airport disturbance is an externality that is forced upon property owners, consistently (Bell, 2001). For the vast majority, noise is a noteworthy concern and there is a portion of the population that would not live below an aircraft way. Astoningshly, there is a portion of the people that will buy residential property nearby airport whenever enticed by discounted property costs. In the midscale are individuals who possess or buy a property in the region of an airport that is affected by disturbance. The houses have similar characteristics, value and size as houses rated in the high-income area. However, the impact of aircraft noise on residential property values has not yet been adequately considered in Namibia in general and at Eros Airport in particular. Therefore, this study is essential for filling an apparent gap of the effect of aircraft disturbance on surrounding environment and residential properties at Eros Airport, Namibia.

1.4 Aim and Objectives of the Study

1.4.1 Aim

This study's aim was to assess the impact of aircraft noise on the surrounding residential property values adjacent to Eros Airport in Windhoek, Namibia.

1.4.2 Objectives

The study was guided by the following objectives:

- To examine the impact of noise emitted from aircraft on residential property values around Eros Airport.
- To determine the effects of aircraft noise on recreational activities at residential properties near Eros Airport.
- To identify the best possible interventions to minimise the negative impact of the aircraft noise on the location of the residential areas near the airport.

1.5 Research Questions

The following questions were developed and structured in order to substantiate the stated research objectives:

- What is the impact of aircraft noise on residential property values around Eros Airport?
- What are the effects of aircraft noise on recreational activities at residential properties situated within the vicinity of the Eros Airport?
- What are the best possible ways to avoid/minimize the negative impact of aircraft noise on the location of the residential areas near the airport?

1.6 Research Hypothesis

The following hypotheses were developed:

Ha: There is a significant positive relationship between residential property values and aircraft noise in Academia, Pionierspark and Olympia.

Ho: There is no significant positive relationship between residential property values and aircraft noise in Academia, Pionierspark and Olympia.

1.7 Limitations of the Study

Most of the medium-sized airports in Namibia are within the residential areas or a few kilometres away from the suburbs or locations of residential properties such as houses, schools, shopping malls and apartments or other residential buildings. Thus, some of the collected data were incoherent and rendered usable.

1.8 Delineation of the Research

Although the disturbance caused by aircraft on human activities has a negative effect on human health, this study was centred on the effect of aircraft noise on residential property values around Eros Airport and not on any other area or aspect of the inhabitants of the surrounding areas.

1.9 Significance of the Research

This research provided information to future property buyers and estate agents on the effect of aircraft noise from medium-sized general aviation airports, such as Eros Airport on residential property values. Furthermore, the study helped generate an insight into an understanding of the implications associated with aircraft noise on general community living close to the airport rather than those that are at a distance from the airport. This has the potential of assisting airport authorities to ensure proper planning in the future for the establishment of airports to avoid having a negative impact on the surrounding

communities. The study also contributed to the existing body of knowledge and scholarly understanding in respect of the effect of aircraft noise on the property values in developing countries.

1.10 Chapter Summary

Historically, the Eros Airport was built about 4 km from Windhoek's CBD in the 1950s. It is the second largest airport in Namibia and the busiest airport with regard to international flights. During the colonial years of South Africa and South West Africa, residential properties were developed in open areas surrounding Eros Airport, which were exposed to aircraft noise. These suburbs are Academia and Pionierspark with Olympia being slightly further away. There were also racial implications during the colonial era because all races could not live in the same area. Only Europeans with high-level income were settled in the above-mentioned suburbs and were not exempted from challenges of environmental problems and the decrease in their residential property values caused by aircraft noise. The effects of aircraft noise may affect the environment, social, human health and normal daily activities of the human population surrounding the airport. Therefore, it is fair to state that noise pollution affects productivity, outdoor recreation, living and family activities. Thus, the surrounding residential property values could be negatively affected by aircraft noise. Therefore, this study has only focused on the impact of noise pollution of aircraft from the Eros Airport on surrounding residential properties value.

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[1] The distance from the airports to the suburbs for the residential properties is a minimum distance of zero kilometres and a maximum distance of 1 kilometre.

STRUCTURE OF THE DISSERTATION

Chapter One - Introduction

This chapter presents the introduction and the argument of the research problem, context and rationale for understanding the study.

Chapter Two: The literature review

This chapter provides a review of the literature related to this study. It covers subjects in the area of this research and provides an understanding of how aircraft noise affects residential property values in close proximity to the airports, globally**.**

Chapter Three: Research Design and Methodology

This chapter provides a details description for the research methodology used in the study to collect and analyse the data. The method of collecting data using mixed methods, defined as a combination of quantitative and qualitative methodological analyses, is discussed. Ethical principles applied in the study are also discussed.

Chapter Four: Research Findings

This chapter presents a descriptive analysis and results presentation obtained in this study.

Chapter Five: Discussion

This chapter deals with a discussion of the findings derived from the Qualitative and Quantitative data analyses used in the study.

Chapter Six: Conclusion and Recommendations

This chapter summarises and concludes the research findings based on the research questions and, provides recommendations for future research.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Several researches conducted worldwide on aircraft noise have shown that aircraft noise has an impact on humans as well as on the surrounding environment (Aliyu *et al.*, 2016). Trojanek *et al.* (2017), determine that, aircraft noise has a negative impact than other noises, which is possibly a significant issue for residential properties surrounding any airport. Other scholars (van Praag & Baarsma, 2005; Jiao *et al.*, 2017) have stated that the measurement of the financial value of quietness has traditionally concentrated on the effect noise exposure has to the value of residential property. This chapter therefore provided insights on aircraft noise from previous scholars and studies, in an attempt to find mitigating measures towards aircraft noise. The chapter starts by defining aircraft noise as observed in different context by various scholars. Then the review also looked at associated challenges impacted on residential properties value in respect to aircraft noise in areas surrounding airports. The chapter further went on to establish from previous results and findings what could be the effect of aircraft noise on recreational activities in areas surrounding airports. Lastly, the chapter reports on literature that determined the best possible ways to avoid/minimise the negative impact of aircraft noise in communities near airports.

2.2 Aircraft Noise

Noise is defined as 'capable of being heard acoustic vitality' that influences the mental and physiological prosperity of individuals (Sanghal *et al.*, 2009). Noise pollution is part of the natural burden on the environment by airports in close proximity to habitable regions that has the most genuine effect on the inhabitants in the areas. Noise pollution due to aviation causes ecological harm to individuals living close to the airports, and, by implication affects residential property values as well. Thus, aircraft noise falls into the class of sound that is unwanted (Nchemanyi, 2006). There are many different types of noise, and aircraft noise is categorised as transportation noise, which falls into the same category as road noise and railway noise (Nchemanyi, 2006). Several studies have been conducted on the effect of noise, which differs according to the type of noise generator. There are varieties of resonances on the planet, however not all are unpleasant to the surrounding areas and therefore, cannot be regarded as noise in the sense that is used here. Aircraft noise is one of the airport-related noises such as traffic noise (that the aircraft makes in the air, when its take-off and land).

Although there are many definitions of aircraft noise, this research adopted the definition by Nelson (2004), wherein aircraft noise is described as the undesirable sound generated by aircraft that may be

annoying or may interfere with human activities. Several studies have investigated the impact of airplane sound on financial worth of properties as well as human's welfare close to the airport. For example, human activities affected could be a discussion, watching television, schoolwork discussions, outside amusement as well as family deeds of residents residing near the airports. Several studies have examined the effect of aircraft noise on residential property values. Some of the studies have provided data on the estimated percentage loss of residential property values due to airport noise of varying intensity (Bell, 2001; Nelson, 2004; Hajnal, 2017; Basner *et al.*, 2017). The problem of aircraft noise became well known around the 1950s with the introduction of jets into commercial air travel (Huff & Envia, 2007). However, Horonjeff and McKelvey (1983), stated that resistance to aircraft noise has been dynamic and it continued when jets started operating more frequently.

Aircraft noise is an unpleasant pollution generated by an aircraft and it affects the neighbouring areas including the value of residential properties around smaller or large airports (Huderek-Glapska & Trojanek, 2013:397). Aircraft noise emissions have become a serious concern around all residential areas near the airports and under aircraft's flying pathways. However, the reception of quieter aircraft and engine technology has made the circumstance less bothersome (Bell, 2001). The occurrence of aircraft noise is part of numerous aspects the buyer considers when purchasing or selling a residential property. Therefore, Nchemanyi (2006), states that the airport could be viewed as an unpleasant neighbour because it creates a nuisance that affects property values and the natural aesthetic of residential properties nearby an airport with inhabitants felling unsafe and having unhealthy and unenjoyable daily lives.

While most studies' emphasis was on the effects of aircraft unpleasant sound at major international airports worldwide, the research has not come across any study focussing on the effect of aircraft noise on the residential properties surrounding the Eros Airport in Windhoek, Namibia. However, aircraft noise generated from Eros Airport may have the potential to affect nearby residential property values. In 2016 Eros Airport handled 17 620 aircraft movements and 74 356 passengers (Namibia Airports Company strategic plan, 2011-17). Most of the noise generated comes from private, commercial and jet aircrafts such as Cessna 201 aircrafts, which are regularly utilized aircrafts for contract and fly-in safaris in Namibia. A study conducted by Nchemanyi (2006), on population opinions on disagreeable sound produced by aircrafts at the Cape Town International Airport, found that aircraft noise might diminish the value of housing, dwellings, and cause an unsettling feeling to individuals who live and work near the airport. Additionally, evidence from some studies provides sufficient proof that aircraft noise can cause problems that include human health and a decrease in youngsters' learning capacities (Evans *et al.*, 1995).

A research by Pennington *et al.* (1990), at Manchester International Airport, analysed the association between airport noise and neighbouring housing prices. Although more individuals will probably decide not to live in a property that is affected by airport noise, the outcomes from the examination showed that the financial costs of properties around Manchester International Airport were not influenced by airport activities and aircraft noise. However, aircrafts unpleasant sound pollution remains a matter of concern for numerous airports, particularly where the airport capability and aircrafts activities are expanding. Additionally, the Airport Cooperative Research Programme (ACRP) reports that annoyance has always been considered as one of the factors that can be caused by aircraft noise (Hall, *et al.*, 2008). Aircraft noise has a disturbing effect and many people attempt to avoid it and end-up relocating from an area that is close to the airports to other quieter locations. The noise can have a negative effect on housing financial costs and can likewise influence the surroundings' recreational activities.

Noise is classified into two main groups: occupational noise and environmental noise/pollution (van der Merwe & Von Holdt, 2005). Environmental noise is described as noise, which is generated by a variety of sources and then circulated outdoors through the air to receivers who might be positioned either near or far the sources of the environmental noise/pollution (van der Merwe & Von Holdt, 2005). Occupational noise is regularly a word utilized in connection to ecological wellbeing and security as opposed to a disturbance, as continued contact can cause perennial hearing harm (Agarwal *et al.,* 2016; Kerdonfag *et al.,* 2019).

Aircraft noise, which is classified as transportation noise, is within the group of environmental noise, which can decrease the value of surrounding residential properties. Aircraft noise, primarily jet noise, contrasts from other ecological pollution by the dominance of a greater rate sound, which could be irritating, particularly to the human ear thus, decreases the surrounding property values. Aircraft noise can affect houses around the airport with lower market values comparable to houses distance away from airport (Espey & Lopez, 2000). The aircraft noise problem is more than likely to be caused by jet aircrafts, which are the most common aircraft to use large airports (Min, *et al.*, 2015). Jets are amongst aircrafts using Eros Airport.

2.3 Residential Property Values

According to Tse and Love (2000), residential property is characterized as a multi-dimensional item, which is portrayed, by permanency, auxiliary firmness just as spatial fixity. Every residential entity has

its particular bundle of attributes its approachability to work, transportation, conveniences among the basic attributes, including surroundings and environmental quality. Residential property is both a source of prosperity and economic development in many countries globally including Namibia (Coffee *et al.*, 2013). It is any property, which the municipality or private corporations have designed for people to live in, such as single-family homes, apartments, co-operatives and townhouses. The price of a house differs from the cost of the dwelling services it provides, though the two concepts such as aircraft noise and residential property value are naturally interconnected.

According to Coffee *et al.* (2013), residential property is among the most significant resources individuals possess and consequently gives the possibility to be utilized as a financial status measure. However, owing to the advent of technology, which led to the establishment of airports around Namibia, such as Eros Airport, there are various effects on the survival of residential property values. Consequently, this study intends to investigate the potential impacts of noise on residential property values around the Eros Airport in Namibia.

Overall, residential property values depend on the size and the number of bedrooms, bathrooms, kitchen and garage (Mihaescu & Vom Hofe, 2012). Additionally, the residential property values rely upon the natural environment of the area where by it is situated. Environmental factors influence residential property values in a significant manner. Human beings' behaviours are not impartial to the encompassing natural area for the basic reason that they change their personal needs and living conditions in relation to the area and the environmental characteristics of a specific region. These living circumstances and personal needs define and influence the property values.

A research conducted by Sukismith and Nitivattananon (2015), at Thailand's Suvarnabhumi Airport on the appliance of a possible evaluation of reimbursement package, revealed that noise pollution has a larger influence on housing costs than of an air pollution. However, other studies on residents and businesses have shown identical outcomes on the adverse influence of noise, and air pollution on property costs, whereas, albeit noise has a bigger effect (Espey & Lopez, 2000). The inhabited property and residential property values are determined by the relationship between those factors as well as surrounding airports. Residential property values decrease with proximity to the airport owing to harmful elements such as aircraft noise.

The worth of residential property that is near the airport could have a decreased environmental appeal, which is precipitated by using aircraft noise pollution as an assessment criterion for residential areas situated far away from the airport (Crowley, 1972; Whitelegg, 2000). However, air pollution impact on property costs for residences used to be fairly larger than for organizations (Sukismith & Nitivattananon, 2015). Possibly, some residential property owners who are located close to Eros Airport came after it had been established. The purpose of establishing the airport was to procure employment opportunities and access to secure transportation. Other residential property owners who own houses near the airport area, but are working far from the location, might have located there for different reasons. The reasons could be that during the time of settling, the airport was not a commercial facility and there was not too much movement of aircrafts and therefore less noise pollution.

2.4 Effects of Aircraft Noise on Recreational Activities

A number of studies were conducted on residents' behaviour relating to aircraft noise. These studies examined the impacts of aircraft noise on social and environmental noise problem of the recreational events within the vicinity of airports by factoring in Hedonic prices models to measure the impact on recreational activities and on values of residential properties located in close proximity to the airports. Krog *et al*. (2010), examined the behavioural answers to changes in aircraft noise experience in regional outdoor leisure areas surrounding the airports. The outcomes of the research indicated that exposure to aircraft noise may motivate a decision for personal use of open-air leisure spaces. Thus, cautious consideration is required when planning residents' outdoor leisure areas around airports. Aircraft noise pollution has a negative effect on social events such as sporting activities, rest/leisure and sleeping (Issarayangyun *et al.,* 2005). Similarly, children are not spared from aircraft noise pollution, as they are often annoyed just like adults (Münzel, *et al.,* 2018). Therefore, aircraft noise interferes with the ability to perform duties and causes momentary listening impairments.

Additionally, the effects of aircraft noise on residential costs are an indication of the influence of an airport on its adjoining area. The impact of airport noise is an exterior factor, which indirectly affects society as an alternative than direct users (Trojanek, 2014). The impact, which is often revealed through a variation of property costs, is triggered by airport activities. These impacts (external sometimes) are mostly negative (lower house costs). The negative exterior impacts are the result of airways using an airport's infrastructure than of the airport activities. Aircrafts generate unpleasant sound and noise pollution, which decreases the comfort of residents close to the airport (Trojanek, 2014). Furthermore, there are several limitations regarding the use of properties placed near the airport. These aspects result in a decreased hobby in those properties and, lead to the decrease in residence values (Trojanek, 2014).

However, flights noise impact negatively on property values and the market fees of residential homes situated close to the airport (Kopsch, 2016; Renigier-Bilozor *et al.*, 2017).

While several studies focused on aspects affecting property costs, they were aimed solely on the correlation concerning noise effect and modifications/variations in housing costs. This study gave an extra information on several aspects affecting residential property values. Thus, there is no uncertainty that a continuous increased in aircraft noise will diminish the value of residential properties and leads to serious health and environmental problems for humans and those airport's surroundings, respectively. The three aspects influencing noise burden are: (i) the excessive quantity of flights landing and taking off daily at the airport; (ii) the sound produced by the rotation of the engine components and the airflow and its direction around the surfaces of the aircrafts; and (iii) noise from the aircraft systems, in particular when aircrafts are flying low at excessive speeds.

2.5 Best Possible Ways to Avoid/Minimise the Negative Impact of Aircraft Noise

The airport authorities have adopted two ways of minimising the effect of aircraft noise on housing prices. These are; a reduction of noise stages coming from a single aircraft and the ongoing assessment of air pollution levels within the airport using modern technology (Smith, 2004). Furthermore, many people are concerned about the environmental impact of flying, but modern technology is aiming at getting quieter aircrafts throughout the world. Leylekian *et al.* (2014) and Min *et al.* (2015), mentioned technologies to limit aircraft noise and viz. engine nacelle, fan, jet and exhaust technologies, and finally the airframe noise. However, the impact of aircraft noise continues to affect negatively residential property prices around the airports.

2.6 Chapter Summary

The literature overview undertaken in this research highlights the impacts of aircraft noise on neighbouring airport properties. Worldwide, scientific reports have determined that aircraft noise impacts negatively on residents and decreases property costs. Other literature has indicated that aircraft noise falls into the class of unwanted sound generated by using aircrafts that may be annoying or interfere with human activities and affecting their health. Additionally, this prompts inhabitants to feel unsecured culminating in a perceived unhealthy environment. One of the types of aircraft noise is from ground activity and traffic at the airport. Overall, some studies have provided data on the estimated percentage loss of residential property values caused by airport noise of varying intensities. Additionally, evidence from some studies gives advantageous proof that aircraft noise can cause challenges that include illness and decrease in school going kids' academic capabilities. Therefore, the airport could be viewed as an

unfriendly neighbour because it creates a nuisance that influences property values and environmental quality.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter is devoted to the research design of the study and various procedures and processes that were followed to collect and analyze the data. Further, it outlines all components of the methodology. This chapter also elaborated on the adherence and application of ethical principles to the study.

3.2 Research Paradigm

According to Collis and Hussey (2014), a research paradigm refers to a philosophical framework that includes a worldview or set of assumptions and beliefs, values and methods guiding how scientific research should be conducted. A research paradigm has been viewed as "a way of examining social phenomena from which particular understandings of these phenomena can be gained and interpreted (Saunders, 2012). Since this study adopted a mixed method, it is therefore, outlined into two paradigms of positivism associated with quantitative research design and interpretivism associated with qualitative research design.

3.3 Research Design

Previous studies defined research design as a structured framework or a plan in which a researcher plans to undertake a research to solve the research problem (Creswell, 2003; Saunders, 2011). According to Cooper and Schindler (2011), the research design facilitates the study's efficiency and produces useful information.

The research design gives a thorough arrangement of how a unique research strategy and methodology techniques achieved in this study are used to collect and analyse data. To overcome the gap in this study, the research used the qualitative method, where in few instances; a quantitative method was adopted to fully explore the impact of aircraft noise on the cost of residential properties in neighbourhoods near the Eros Airport in Windhoek.

3.3.1 Qualitative Research Design

Qualitative research design is defined as a systematic scientific investigation, which seeks to build a complete, descriptive, and narrative to inform the researcher's understanding of a social or cultural phenomenon (Sileyew, 2019). To add to the latter, Hammarberg, *et al.* (2016), explained that qualitative research focuses on the gathering, breakdown, and interpretation of data that cannot be easily reduced to numbers. In this study, a qualitative approach was used, as Hammarberg, *et al.* (2016), further narrated, it was necessary so that such approach allows issues to be examined in detail and in depth,

especially whereby interviews are used for data collection in an unrestricted manner with the guided/redirected questions by the researcher in real time forming the basis of some interviews. Research approach of this nature is, relevant in deepening an understanding of how aircraft noise impacts on residential property values and the surrounding environment around the airport. Consequently, in this study, the information was used to provide detailed assessments on the impact of aircraft noise on the financial value of the residential properties near the Eros Airport in Windhoek. Qualitative research design, therefore, allowed for the in-depth analysis of the impact of aircraft noise on the values of residential properties near the Eros Airport in Windhoek.

According to Smith and Schurink (2005), a qualitative selection procedure is a theoretical sampling and as such it is the method of sampling employed in a snowball or chain sampling, whereas cases of interest can be identified "from people who had information pertaining to the study. Duffy (1987), concurs that the strength of a qualitative method is that the researcher gets the first-hand experience with the interviewees, thereby obtaining valued and significant data. Bryman (2008), argues that as the researcher and participants spend more time together, the collected data is likely to be valid and honest. However, this qualitative research method had limits mainly in gaining unprovable data. Furthermore, Bryman (2008), stated that, the researcher can be easily influenced. To overcome these limitations, the researcher used a qualitative research paradigm with a few occasions were quantitative methods were adopted to minimise bias as well as to get valid and accurate results. Within this mixed methods approach, interviews were employed as a data collection technique.

3.3.2 Quantitative Research Design

According to Apuke (2017), a quantitative research design deals with quantifying and analysis of variables in order to achieve an outcome by involving the use and analysis of numerical data. Quantitative research approaches are research methods that are used to collect quantitative data that can be sorted, classified and measured (Kothari, 2004). Quantitative research was therefore used because according to Connolly (2007), data can be calculated and further analysed by a computer software such as statistical package for social science (SPSS). This was found to save lot of energy and resources (Bryman, 2012). It is also easy to generalize data collected and analyse it through a quantitative research approach. This method was used to find out if there was causality between residential property values and aircraft noise experienced in the study area. Overall, the quantitative method focused on the collection of data through semi-structured interviews conducted with a selected sample of residents that are living in the study areas for four to ten years. The strength of such an approach is to minimise bias and ensure objectivity.

According to Saunders *et al.* (2007), a sequential mixed method involves more than one phase in the data collection and analysis process– one phase elaborating or expanding on findings from the other phase. In this study it was the qualitative research paradigm which took the centre stage with a few instances were quantitative methods were adopted to fully explore the impact of aircraft noise on the value of residential properties near the Eros Airport in Windhoek. Therefore, the use of such both methods has enabled the execution of this study.

3.4 Research Method

3.4.1 Population

The target population of this study encompassed 1 800 households of the suburbs of Academia, Olympia and Pionierspark, which are located on the windward side of Eros Airport Namibia. The suburbs of Academia and Pionierspark were selected as the study areas because they are closed to the Eros Airport and are perceived to be affected by aircraft noise. The suburb of Olympia is one of the farthest residential zones from Eros Airport but shares similar characteristics with Academia and Pionierspark. Therefore, Olympia was included in the study for comparison purposes. Furthermore, the population included 20 key informants who comprised 10 Real Estate Agents, 5 officials from the Namibia Airports Company and 5 individuals from Property Valuation Namibia.

3.5. Sampling Method and Sample Size

3.5.1. Sampling Methods

Sampling is the process of selecting a group representative from the population under the research study. The study used a probability and non-probability sampling methods because it adopted a mixed method. Non-probability sampling is when members of a population do not have an equal chance of being selected to represent the population. This method does not consider randomisation as an important aspect in selecting the sample from the population (Gogtay and Thatte, 2016). Non- probability includes convenience sampling, purposive sampling, quota sampling and snowball sampling. Probability sampling is when all units of the target population have a nonzero probability to take part in the study, meaning that all participants are equally likely to be selected in the study (Martínez-Mesa *et al*, 2014).

3.5.2 Sample Size

The population of the study area is often too large, thus it is practically impossible to collect data from all individuals in the population (Jebe, 2018). To avoid this challenge, the researcher has to select a

sample that is a characteristic of the total population of the study area. The study sample was made-up of 120 participants. The sample was drawn from the 1800 households around Eros airport, which include Pionierspark, Academia and Olympia. Table 1.1 below illustrates the sample size of residential properties.

Table 3.1 Sample size of residential properties

Name of residential property	No.
Pionierspark	40
Academia	40
Olympia	40
Total	120

As shown by Table 1.1 a total of 120 respondents were from the 1800 households and were randomly selected to participate in the study i.e, to select the 120 participants a systematic random sampling technique was utilised. The samples were drawn from residents of ages 18 and 75 years.

Another sample of 20 participants was drawn from 10 Real Estate Agents, 5 officials from Namibia Airports Company and 5 individuals from the Property Valuation Namibia. A table below shows the sampling size of key informants.

Table 3.2 Sample size of key informants

Key informants	No of responses.	Non responses
Real Estate Agents	8	2
Officials from Namibia Airports Company	2	3
Property Valuation Namibia	2	3
Total	12	8

As shown in Table 1.2 a total of 12 respondents were the key informants. The purposively targeted participants were estate agents (EAs, n = 8), Property Valuation Namibia (PVN, n = 2) and Namibia Airport Company (NAC, n = 2) bringing together the total number of respondents to (n=132).

3.5.3. Sampling Techniques and Procedures

3.5.3.1 Random Sampling Technique

This sampling technique was used to select participants from the suburbs. Random sampling is a probability sampling method where all members of a particular population for the study area of interest

have a predetermined probability of being selected for participation (Martínez-Mesa *et al,* 2014). Kothari (2004) agreed to the above definition by adding that random sampling provides every category of the population with the same possibility of being picked as well as every individual in the whole population to have the opportunity to be included in the sample. Under the random sampling method, the researcher used the systematic random sampling technique in which every fifth house from each street in the suburb was picked until a required number of participants was reached. A group of 120 respondents were randomly sampled, one per household respectively from a subset of 120 out 1800 households residing in the suburbs located far away and in vicinity of Eros Airport respectively, i.e. Olympia, Pioneerspark and Academia. The samples were drawn from residents at the ages ranged between 18 and 75 years. An equal number of forty (n=40) participants from all suburbs (Pionierspark, Academia and Olympia) were selected respectively. This was done with the assistance of a list of residential properties and a map of suburbs from the City of Windhoek Council.

3.5.3.2. Purposive Sampling Technique

This sampling technique was primarily used to select key informants from Estates Agents, Namibia Airports Company, and Property Valuation Namibia. The purposive sampling technique is a non-probability technique where the researcher's sound decision is used to select the participants in the research study (Black, 2010). Purposive sampling technique becomes a good alternative when researchers encounters certain constraints (Saunders *et al*., 2012). This means that the researcher uses personal judgement to select participants in the research; i.e. individuals that can deliver enough information that would assist the researcher to answer the research questions and attain the research objectives (Creswell & Plano Clark, 2017). Purposive sampling is mostly used in studies where information samples need to be selected to provide more data on the phenomenon being studied (Palinkas *et al*., 2015).

To justify the above, the researcher selected informants because they have information and are knowledgeable about the effects of aircraft noise on the surroundings and residential property values. Purposive sampling also assisted the researcher to select informants with relevant information that would assist the researcher to answer the research questions and objectives. A total of twelve (n=12) key informants were purposively selected to provide information on the noise impact of Eros Airport to its surroundings. Eight respondents i.e. from Estate Agents, while PVN and NAC had two officials each. The purposively targeted participants were Estate Agents (EAs, n=8) included Property Valuation Namibia (PVN, n=2) and Namibia Airport Company (NAC, n=2) bringing the total number of respondents to 132.

This was because these key informants had thorough information regarding the effects of the airport noise on the surroundings and residential property values.

3.6 Data Collection Instruments

The research only used primary sources for data collection. This included semi-structured interviews conducted for three months after working hours since most of the house owners from the three suburb spend their whole day at work; hence, interviews during working hours was the least favourable time. Questionnaires were conducted to provide answers to objectives "determine the effects of aircraft noise on recreational activities at residential properties near Eros Airport" and "examine the impact of noise emitted from aircraft on residential property values around Eros Airport". Data was also collected through semi-structured interviews to provide answers to the research objective "examine the impact of noise emitted from aircraft on residential property values around Eros Airport". Overall, both instruments provided answers to the objective "to identify the best possible interventions to minimise the impact of aircraft noise on residential property values". The individual data collection methods are explained in details below.

3.6.1 Semi-Structured Interviews

The researcher used a semi-structured approach to understand the impact of aircraft noise on the surroundings and values of residential property near Eros Airport in Windhoek. Informal interviews were held with the residents as key informants. A semi-structured interview is a verbal exchange between two persons; during which one person, the interviewer, tries to solicit information from another person the interviewee, by asking questions (Clifford *et al.*, 2013). The semi-structured approach was preferred because it allows for a full exploration of the various impacts of aircraft noise on the surroundings and values of the residential property as they allowed the interviewer to pursue relevant questions. Kothari (2004), holds the view that semi-structured interview allows a researcher to search some themes thoroughly leading to a concrete foundation. During the interview, a similar set of pre-determined questions can be posed to each interviewee and expert opinion can be obtained to provide valuable professional insight, which can then be used during the data analysis phase to provide findings for the study. Only residents of the three suburbs; Olympia; Academia and Pionierspark, were interviewed. The questionnaires were given to the residents' houses between May and June 2018. Notes were taken during the interview in order to record events that were considered highlights of the interview. The interviews were also done with key informant officials from NAC, PVN and Estate agents. Participants were briefed before the start of the interview to only present their opinions when giving answers to all questions, as there were no correct or incorrect answers. The questions that were

posed during these interviews corresponded to the objectives of the study. The duration of each interview took at least twenty minutes, depending on other issues that were raised during the interview. The interviews were also done to cater for individuals who were unable to read and write.

3.6.2 Questionnaire

Johnson and Christensen (2004), define a questionnaire as a self-reported way to collect data in which participants to research complete. Questionnaires were mainly used to complement data collected from the interviews. Open and closed ended questions were used. An open-ended questionnaire is to determine the answers that individuals give spontaneously; while a closed ended questionnaire is to minimise the partiality that can arise due to answers suggested to interviewees. The researcher chooses to use questionnaires for several reason, as indicated by Gay *et al.* (2009); 1) Questionnaires are the quickest technique to get information from a huge sample, 2) have standard tools to distribute, 3) take less time and 4) their answers are easy analysed. This method is reliable since the researcher can be less involved. The questions were written in English.

3.7 Data Collection Procedures

The questionnaires were administered to residents in the research areas close to the airport, who shared their knowledge and experiences.

Participants were reminded to inform the researcher to collect the questionnaire once they are done. Space was provided where participants' views were marked in using pencils, which could provide the opportunity or room for corrections if necessary. Data related to residential property values was collected over a period of five years (2011-2015). These years were selected based on the uninterrupted availability of the data.

This method allowed the researcher to turn collected data into numerical data. Data from the qualitative phase of the study were used to elaborate on the results of the numerical data of the study. In order to conduct quantitative method and qualitative data collection adequately, important procedures in research needed to be followed, which were aligned to the type of study being undertaken.

3.8 Data Analysis

3.8.1 Qualitative Data Analysis

Creswell (2003), defines data analysis as the process whereby the researcher constantly reflects on collected data, to gain an understanding and to represent the data in an understandable way. Thus, the researcher then derives meaning from the data represented. Qualitative data were analysed using content

analysis. Content analysis is referred to as a research technique used to make replicable and effective conclusions from texts to the contexts of their use (Bengtsson, 2016). When using content analysis, there are two ways (manifest analysis and a latent analysis) in which data should be analysed and from which the researcher has to choose one (Bengtsson, 2016). The manifest analysis refers to when the researcher describes the actual responses of participants by staying very close to the text, and describing the observable and obvious in the text. However, latent analysis is different from the latter in the sense that it focuses on the interpretation of data to find the fundamental meaning of the text: what the text is talking about (Berg, 2001).

This study then adopted the latent analysis as the researcher wanted to make meanings out of the data collected and thereby making conclusions. To better understand the data collected during the interviews, the researcher transcribed the findings after each day of interview. The transcriptions helped the researcher to identify gaps, which can be resolved during the follow-up interview. The collection of data and the visits to the selected sites provided the researcher with a clear picture of patterns and themes. The nature of qualitative data and the data collected were coded and grouped into themes that arose from the participants' responses highlighting both commonalities and differences in issues raised. Mouton (1996), suggests that highlighting both commonalities and differences is significant in data analysis because it shows that the reporting is full and not selective. The researcher combined the data collected to provide a broader understanding and make sense of noise impact on property values in the affected areas. For the qualitative data aspect, interview schedule from the interviews were used. The interview schedules are important due to the fact that they reflect the views of the respondents adequately at a specific time in the presentation of the results.

3.8.2 Quantitative Data Analysis

This was numeric data that was collected from the participants, which is reported in the form of graphs and tables to show the relationships between variables. According to Welman *et al.* (2005), data analysis by means of statistical techniques helps to examine variables, their effect, relationship and patterns of involvement within our world. This is done with the appropriate statistical tools to test hypotheses. The application used for determining standard deviations, capturing of numbers and producing graphs of the responses from the participants was Statistic Package for the Social Sciences (SPSS). The diagrams contained in this thesis were developed using Microsoft Excel 2010. Landau and Everitt (2004), define the "Statistical Package for the Social Sciences" (SPSS) as a package of programs for handling, analysing, and presenting data, which is widely used in the social and behavioural sciences. The researcher performed calculations of descriptive data including, the measures of central tendency, the

standard deviations and measures of dispersion using this software. This enabled the researcher to variations in the data from the mean.

3.8 Ethical Considerations

Devlin (2006), affirms that ethical considerations in any study are important to prevent untruth data while encouraging a pursuit of knowledge and truthfulness, which is a principal objective of every study. The study adhered to standard of ethical guidelines and principles of confidentiality and anonymity. Although the research had used a qualitative approach and few instances were used with quantitative approach, the nature of qualitative research presents many ethical issues for the researcher during the stage of data collection. The researcher has to interact with the people, and the way the researcher interacts with people is important in ensuring the outcome of the research. The interaction of the researcher with the research participants whether negative or positive, influences the outcome. Before collecting data, the researcher obtained ethical clearance from the Cape Peninsula University of Technology (CPUT)'s ethics committee to obtain gatekeeper permission. The ethical clearance process required the researcher to obtain a letter of authorization from the City of Windhoek to conduct research in Academia, Pionierspark and Olympia suburbs. Authorization letters issued by Namibia Airports Company and Property Valuation Namibia were also obtained to ensure a smooth and accurate communication that hold the principle validity and reliability of the data. English was used to communicate since it's the official language in Namibia (See Appendix 1 for research access, anonymity and confidentiality, no harm to the subject, conformability and ethical clearance).

3.9 Chapter Summary

Chapter three provides the research methodology advocating and demonstrating the use of qualitative approach and quantitative approach to collect and analyse data. The quantitative approach involved the collection of numerical data and analysis for Academia, Pionierspark and Olympia. While, the qualitative approach involved the collection of data through interviews conducted with residents, property valuators, and real estate agents who were involved with house sales in Academia, Pionierspark and Olympia within the period defined in the study and residents who lived in the suburbs mentioned in the study. The findings from the combined approaches and supporting literature are discussed in chapters below.

CHAPTER FOUR: PRESENTATION AND ANALYSIS OF FINDINGS

4.1 Introduction

This chapter presents the findings of the study in line with objectives set out in chapter one. The guiding subheadings are as follows: Impact on residential property values, social and environmental impact of the location of the Eros airport and ways of mitigating the negative impact of the Eros airport. The chapter presented data collected and analyzed through both qualitative and quantitative research methods.

4. 2 Quantitative Data Presentation and Analysis

This section presents and analyze quantitative data collected through questionnaires

4.2.1 Impact on Residential Property Values: Results from Estate Agents, and Property Valuators

4.2.1.1 House Property Values over the Past Five Years

The information tabulated below indicate house values over the past five years. The average house value for the five-year period were extracted from appendices 9 and 10, with the indicated values being supplied by PVN.

Table 4.1 Average house values

Suburb Name	**Average Property Values in Namibian Dollars (N$)**				
	2011	**2012**	**2013**	**2014**	**2015**
Academia	1681521	2345000	2171800	2278250	3167500
Pionierspark	1544750	2188500	3125000	2682500	3262500
Olympia	1 700 000	2 900 000	3 600 000	1717500	3919100

Table 4.1 above shows the available data provided by Property Valuators of Namibia (PVN) for the average prices of residential properties in Academia, Pionierspark and Olympia from 2011 to 2015. The average price of the residential properties determines the variation and appreciation in properties values from 2011 to 2015. Thus, the Table (4.1) depicts the average values of all the above-mentioned suburbs having appreciated for the five-year period (from 2011 to 2015). For example, a property, which was valued at N $1.7 million in 2011, was revalued at N$3.9 million in 2015 in Olympia. Similarly, increases

for Pionierspark were from N$1, 5 million in 2011 to N$3.2 million in 2015, while Academia had the lowest average values of N$1, 6 million in 2011 and N$3.1 million in 2015. The general trend in Table 4.1 is that the values of residential properties increased steadily from 2011 to 2015 with Olympia having the higher increases in value throughout the five years. However, a marked decrease in property prices was recorded across the board in 2014. This decrease coincided with the increased municipal land servicing and delivery during that same year (FNB Property Report, 2019). The overall average price of the residential properties in the jurisdiction increase are illustrated in Appendix 9. Additionally, Table 4.3 enlist a measure of dispersion for the suburbs studied.

From this data, the impact of aircraft noise at the Eros airport on residential property value is not necessarily negative especially to areas not in close proximity to the airport such as Olympia.

4.2.1.2 Measure of Centre of Tendency: Computations

a) Mean: Is the average of all values in the data set. All the values were added together and divided by the number of values in the data set in each suburb. For example, Academia: (1681521 + 2345000 + 2171800 + 2278250 + 3167500)/5 = N$2328814
b) Median: Is the middle value in the data set and in the case of Academia, the values were arranged from the smallest to the largest; 1681521, 2171800, **2278250**, 2345000, 3167500, therefore, **2278250** was the median and
c) Mode: Is the value that appears frequently in the data set, however, there is no number that appears more often in the data set for all the suburbs studied.

These calculations were done for all suburbs and yielded the results as shown in Table 4.2, demonstrating the measure of central tendency and distribution for the studied suburbs.

Table 4.2 Measure of Central Tendency and Distribution between 2011 and 2015

Parameter	**Academia**	**Pionierspark**	**Olympia**
Mean (N$)	2 328 814	2 560 650	2 767 320
Median (N$)	2 278 250	2 682 500	2 900 000
Mode (N$)	-	-	-

Overall, Academia recorded the least price value mean (2 328 814), the median (2 278 250) and the range (1 485 979) while, Olympia records indicated the highest (2 767 320 mean and 2 900 000 median)

as well as the range (2 219 100) being different, respectively. Pionierspark was closely related to Academia on all the measurements of the central tendency/location.

4.2.1.3 Measure of Dispersion

Measure of dispersion is used to describe the degree of spread or distribution of data (Sheard, 2018). This study has only used the variance, interquartile range and standard deviation to measure dispersion, which were calculated as follows:

a) Range: Is the difference between the highest and lowest value in the data set, for Academia as previously used as an example in the measure of centre of tendency, (3167500 – 1681521) = 1485979
b) Variance: It measures the spread out of a set of numbers/data from their average value. It was calculated by averaging values of the squared differences of each value and their mean. An example for Academia was calculated as: (1681521-2328814)^2 + (2345000-2328814)^2 + (2171800-2328814)^2 + (2278250-2328814)^2 + (3167500-2328814)^2 = 2.87464,
c) Standard Deviation: Measures the average distance between each value and the mean, which is how the set of data spreads out from the mean. A high standard deviation means that the data points are spread at wider ranges of values, whereas a low standard deviation means that the data points are close to mean. This was calculated as the square root of variance; $S=\sqrt{2.87464/5}$ = N$536156
d) Skewness: Refers to the measurement of the asymmetry in the distribution of the data set. For example, the average house value was skewed as some people might have been paying more for a slightly lowered valued house while, others will be much lower to that range due to external factors such as low decimal. The skewness can be positive, negative or undefined as in the case of the data set presented in this study.

Table 4.3 Measure of Dispersion

Descriptive Statistics				
	Parameter	**Academia Average_Prices (N$)**	**Pionierspark Average_Prices (N$)**	**Olympia Average_Prices (N$)**
N	Valid	5	5	2
	Missing	0	0	3
Variance		2.87464	4.9912	1.06971
Range		1485979	1717750	2219100
Standard Deviation		536156	706484	1034269

In the case of Olympia, the standard deviation was high, meaning that there is more variation in the average property values for the suburb compared to the others. All standard deviation for all suburbs was positive. There was less variation in the average property values for Academia.

In terms of variance, Pionierspark's average property values are spread out from the mean and each other compared to other suburbs, albeit Olympia's average property values are closer to the mean. The average property values for Pionierspark and Olympia had farther spread from the central value, which is the median. In respect to the range, Olympia recorded the highest difference between the maximum and minimum average property values than Academia and Pionierspark.

In comparison to the standard deviation calculations shown in Figure 4.1 and measure of dispersion shown in Table 4.3, properties values sampled are closer to the mean in Academia. Whilst, in Olympia, price values had wider spread distribution curve. However, none of average prices could appear more than once; hence, there was no mode within the values.

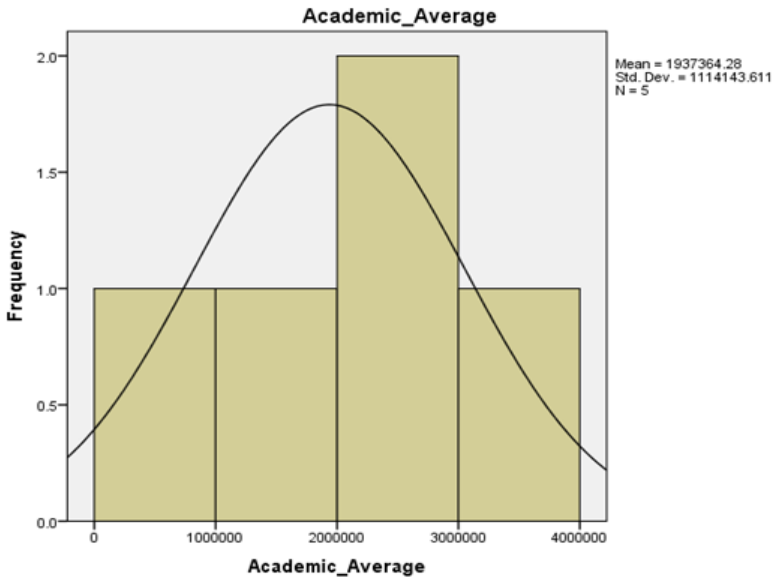

Figure 4.1. Distribution curve for Academia Average Prices

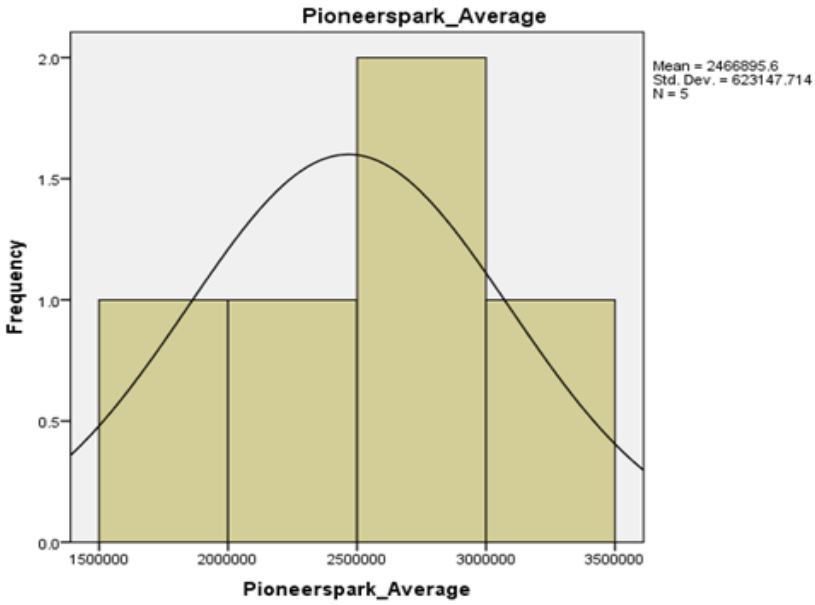

Figure 4.2 Distribution curve for Pionierspark Average

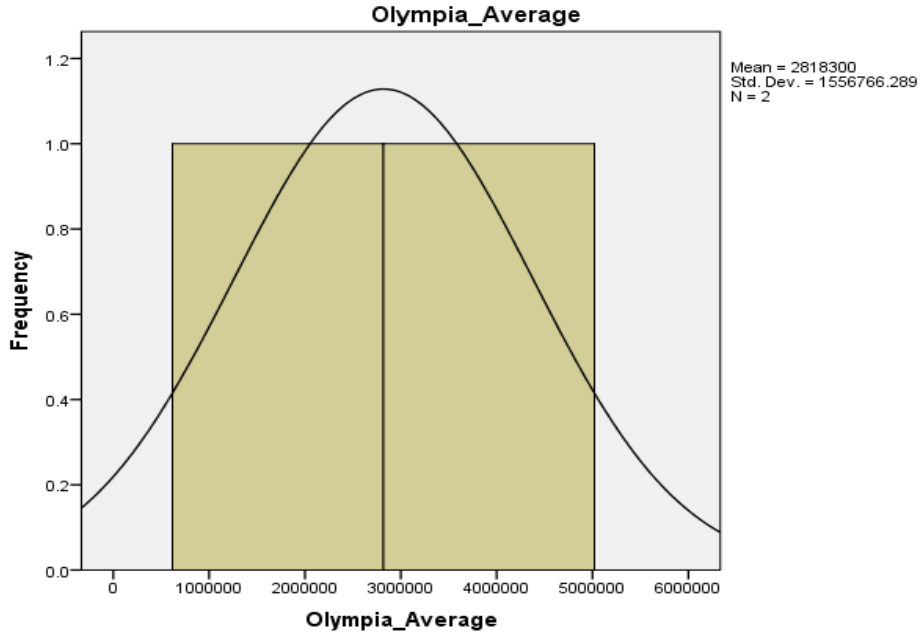

Figure 4.3 Distribution curve for Olympia Average Prices

Significantly, the measure of dispersion is essential in distributing variability and data distribution. Table 4.3 demonstrates statistical variables measured to determine dispersion particularly the skewness and peakness of the distribution curve that shown on Figure (4.1, 4.2 and 4.3). Based on the skewness, Academia has a positive skewness; while Pionierpark and Olympia demonstrate a negative skewness. Academia has a symmetric distribution signifying a normal distribution curve. In comparison,

Pionierspark, has a flat asymmetric distribution skewed to the left whereas Olympia, has a peaked distribution also skewed to the left. Therefore, the result illustrates a diverse distribution in each suburb.

4.2.1.4 Frequency in Selling Properties

The participants from estate agents were requested to show the frequency annually in selling properties. The results from the three residential areas are presented in Figure 4.4.

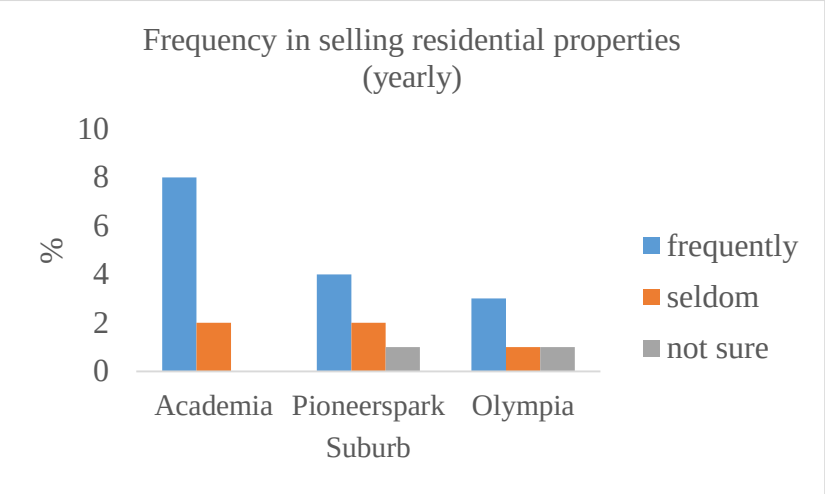

Figure 4.4 Frequency in selling residential properties

Overall, Academia homeowners sold their residential properties more frequently annually, which is about 8% greater than the other two suburbs. The frequency in selling houses in Olympia and Pioniespark was relatively lower in the past five years in comparison to Academia closer to the airport. The trend shown by Figure 4.4 is that the sale of houses closer to the airport was higher as compared to the houses, which are a distance away. This was an indication that the location of the airport had some positive aspects on the residential properties. Overall, other amenities as external factors in the suburbs might have a positive impact on Academia's property market.

4.2.1.5 The Impact of Aircraft Noise from Eros Airport on Residential Property Values

The estate agents were requested to comment if they had met any clients willing to own houses in Academia or Pionierspark. They pointed out that there were some individuals interested in the area although they were concerned about being exposed to the aircraft noise coming from the Eros Airport. The results are summarised in Table 4.4.

Table 4.4. The impact of aircraft noise from Eros Airport on residential property values

Statement on impact of Eros Airport	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Positive impact on the residential property values close to it	0	0	5	5	0
Negative impact on the residential property values close to it	5	5	0	0	0

It was clearly illustrated that half of the respondents (n=5) agreed and a similar number strongly agreed that the residential property values close to the airport were negatively affected. Similarly, this was supported by other five respondents who disagreed that there was a positive impact on the value of residential property situated near the airport.

4.2.1.6 Assessment of Property Clients' Perceptions towards Noise from the Eros Airport

The respondents were requested to comment on their perceptions of noise from the Eros Airport to assess whether those perceptions were translated into sales prices when the residential property was sold.

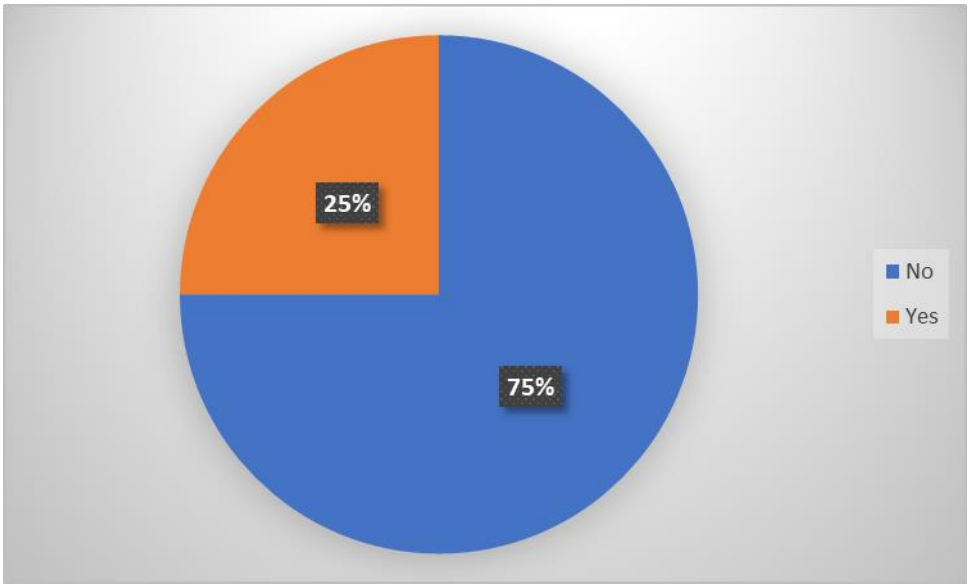

Figure 4.5. Assessment of property clients' perceptions

Figure 4.5 shows that 75% of the respondents indicated that the sales prices were not affected by the noise from the Eros Airport when the residential properties were sold. The remaining quarter disagreed.

4.2.1.7 Provision of Noise Discount Allowance

The respondents from estate agents were requested to comment whether a discount should be allowed on the sale prices because of the noise. Table 4.5 depicts the result on noise discount allowance.

Table 4.5: Provision for a discount allowing for noise

Statement on provision for a discount allowing for noise	**Frequencies**	**Percentages**
No	7	70
Yes	3	30

Table 4.5 shows that the majority, 70%, of the respondents, stated that no provision for a discount allowing for noise has been made. The remaining 30%, however, indicated that provision had been for a discount in lieu of the noise.

4.2.1.8 Need to Inform Homebuyers about Aircraft Operations

The respondents from estate agents were requested to comment on whether they informed prospective homebuyers about the noise levels of aircraft operations near their residential property of interest. The results are summarised as indicated in Figure 4.6.

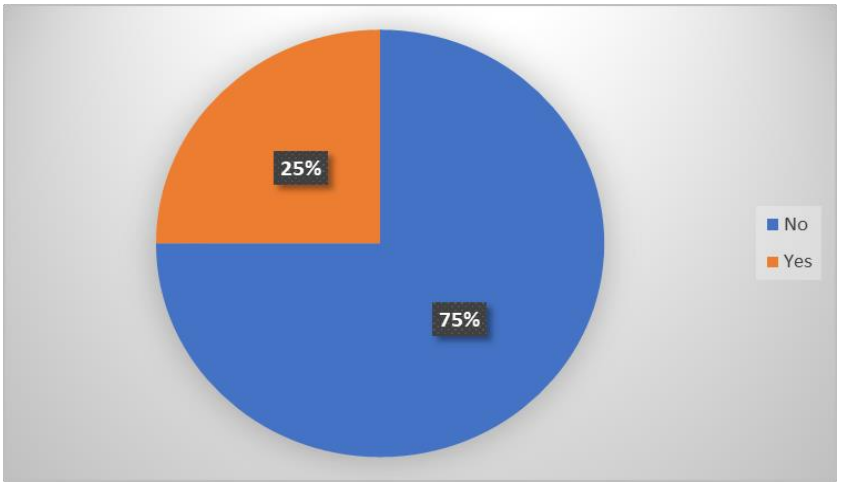

Figure 4.6. The need to inform homebuyers about aircraft operations

Figure 4.6 shows that 75% of respondents indicated that they do not inform homebuyers about aircraft operations. Which suggest that purchasers might be oblivious of noise pollution from the Eros Airport. While, the remaining 25% acknowledged that they informed homebuyers about aircraft operations,

4.2.1.9 Perceptions about the Rate of Depreciation of Residential Properties Close to the Airport

The respondents were requested to comment on whether they knew that residential property rates close to the airport depreciated. The results are shown in Table 4.6 below.

Table 4.6: Depreciation rate of residential property values close to the airport

Statement on depreciation rate of residential property values close to the airport	Frequencies	Percentages
No	3	75
Yes	1	25

Table 4.6 shows that the majority of the participants said they had no idea about the rate of depreciation of residential property values close to the airport. Twenty-five (25%) of the respondents indicated that they had an idea that the value of some residential properties near the airport depreciated or that it might not have appreciated significantly when compared to suburbs away from the airport.

4.2.1.10 Different Evaluations of Houses close to Eros Airport (interview questions)

The respondents were requested to comment whether they evaluated houses close to Eros Airport (Academia and Pionierspark) differently from identical houses that were a distance from the airport, namely Olympia. The results are summarised in Figure 4.7.

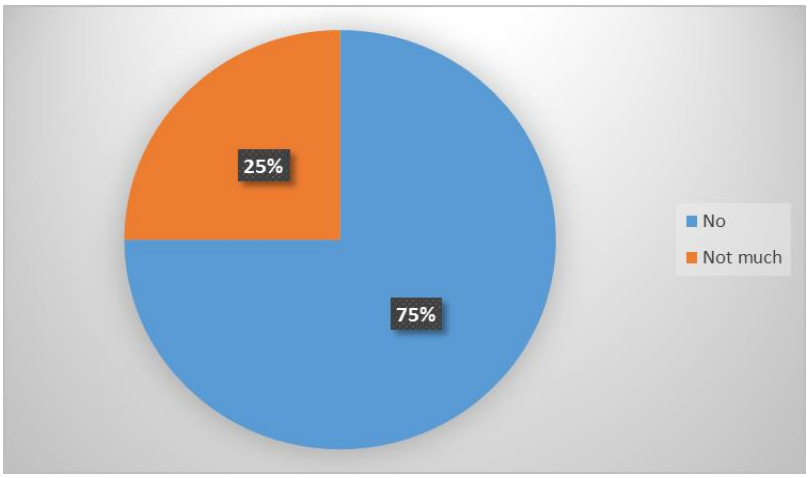

Figure 4.7 Presence of different valuations of houses close to Eros Airport

Figure 4.7 shows that three quarters of the respondents seventy-five (75%) indicated that there was no difference in the valuation of houses close to the Eros Airport and those a distance away from the airport such as Olympia. However, the remaining twenty-five (25%) disagreed.

4.2.2 Impact on Residential Property Values: Results from the Residents

4.2.2.1. Choice to sell Property and Move to a Quieter Area

The respondents were requested to comment on whether they would sell their houses and move to a quieter area. The results are summarised below in Table 4.7.

Table 4. 7: Choice of selling your house and moving to a quieter area

Choice of selling your house and moving to a quieter area	**Frequency**	**Percentages (%)**
Yes	70	58
No	50	42

Table 4.7 shows that more than half (58%) of the respondents had indicated that they would sell their houses and move to a quieter area. The remaining 42% disagreed. One respondent said that the only concern has been about the price of the house at the time he bought it, but did know that aircraft noise would be a challenge in the future. Another respondent said, when he bought his house, he did not think about the impact of aircraft noise on residential property values and only realised it after he had settled. Thus, he now wanted to move to a quieter suburb.

4.2.3 Aircraft Noise and Residential Property Values

The respondents were requested to comment on whether they thought that aircraft noise can decrease their residential property values. The results are summarised below Table 4.8.

Table 4.8: Aircraft noise and residential property values

Can aircraft noise decrease your residential property values?	**Frequency**	**Percentages (%)**
Yes	60	50
No	60	50

Table 4.8 shows that there was a balanced view on whether aircraft noise reduced residential property values. Some respondents in their responses looked unsure or had the fear of being relocated without their consent to other locations if they told the truth by agreeing that aircraft noise could decrease the residential property values.

4.2.4 Social and Environmental effect of the location near the Eros Airport: Results from residents

4.2.4.1 Duration of Stay in the Area

The respondents were requested to indicate how long they had lived in this area. The results are summarised in Figure 4.8.

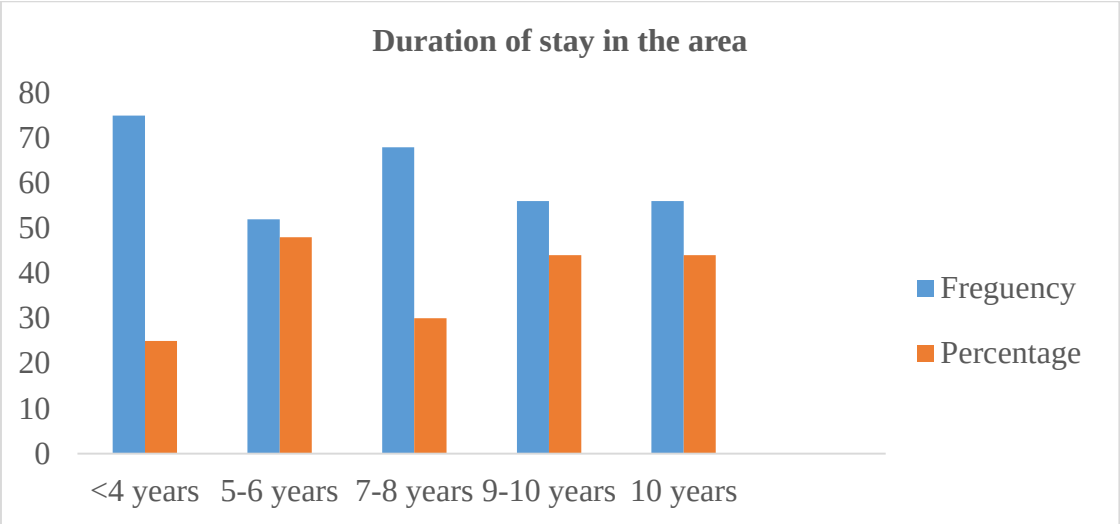

Figure 4.8 Duration of stay in the area

Figure 4.8 shows that 44% of the residents had lived in the area for a duration of nine years or more, while another 31% had lived in the study area between five to eight years. The remaining 25 % had lived in that area for four years or less. Thus, almost half of the residents (48%) had lived in the residential areas of the study for only six years or less. One respondent indicated that he was born, grown up, married and owned a house in Academia. Another respondent said that they had come to Pionierspark five years ago but now were ready to relocate again.

4.2.4.2 Number of Occupants in one House

The respondents were requested to indicate how many people lived in the house. See Table 4.9

Table 4.9: Number of occupants in the house

Number living in the house	**Frequency**	**Percentages (%)**
1 Person	13	11

2 Persons	20	17
3 Persons	36	30
4 Persons	23	19
>4 Persons	28	23

Table 4.9 shows that the majority of the residences (72%) have three or more people living in them. The remaining 28% have either a single individual or two people living there.

4.2.4.3 Complaints about Aircraft Noise

The respondents were requested to comment on whether there were any children in the house who complained about aircraft noise. The results are summarised in Figure 4.9.

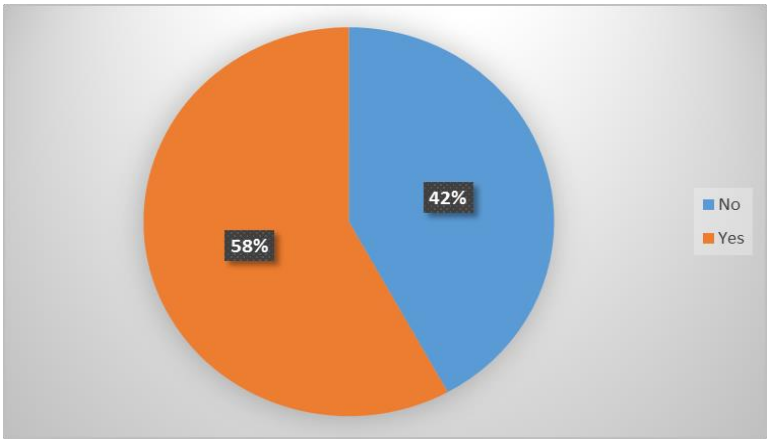

Figure 4.9 Complaints about aircraft noise

Figure 4.9 shows that more than half (58%) of the respondents reported that there were children in the house who complained of aircraft noise. The remaining 42% had a different view and disagreed with this statement. Some respondents explained further that their children had become used to the aircraft noise from the airport and did not complain anymore. They added that they now knew the difference between an aircraft landing or taking off and how long it was on the runway before taking off.

Whereas, one respondent explained that his two children always looked stressed and disturbed when hearing the aircraft noise. They even used to stop eating or pause the television and continue after the noise had faded, which is normal for any other type of noises in our backgrounds such as motorbikes, sport cars in the street and so on.

4.2.4.4 Feelings of Annoyance Caused by Aircraft Noise

The respondents were requested to comment on how often they felt annoyed when they were exposed to aircraft noise. The results are summarised in Figure 4.10.

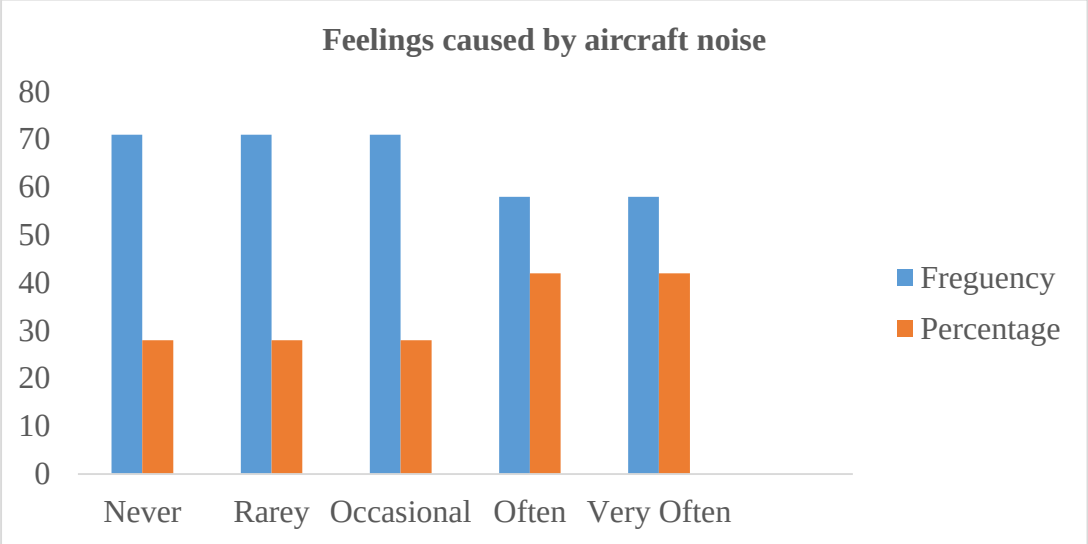

Figure 4.10 Feelings caused by aircraft noise

Figure 4.10 shows that 42% of the respondents indicated that they were often and very often annoyed by the aircraft noise respectively, while 28% either said they were never, or occasionally annoyed with aircraft noise.

4.2.4.5 Neighbours Complaining about Aircraft Noise

The respondents were requested to comment whether they heard any neighbours complaining about aircraft noise. The results are summarised below on table 4.10.

Table 4.10: Neighbours complaining about aircraft noise

Neighbours complaining about aircraft noise	**Frequency**	**Percentages (%)**
Yes	60	50
No	60	50

Table 4.10 shows there is a parity in views on whether they heard any neighbours complaining about aircraft noise or not. 50% did not hear neighbours complaining about aircraft noise, while a similar

number heard neighbours complaining about aircraft noise. One respondent said that her neighbour complained that he likes a quiet area either in the afternoon or at night, but realised that aircraft noise changed the environment he lived in especially during the day, and that this could reduce his residential property value. Another respondent said that he likes to complain about aircraft noise to neighbours, but they always said that they were used to it, because sometimes they could not even hear that an aircraft had landed or taken off.

4.2.4.6 Aircraft Noise and House Damage

The respondents were requested to comment on whether they thought there was any damage to their houses owing to the aircraft operations. The results are summarised in Figure 4.11.

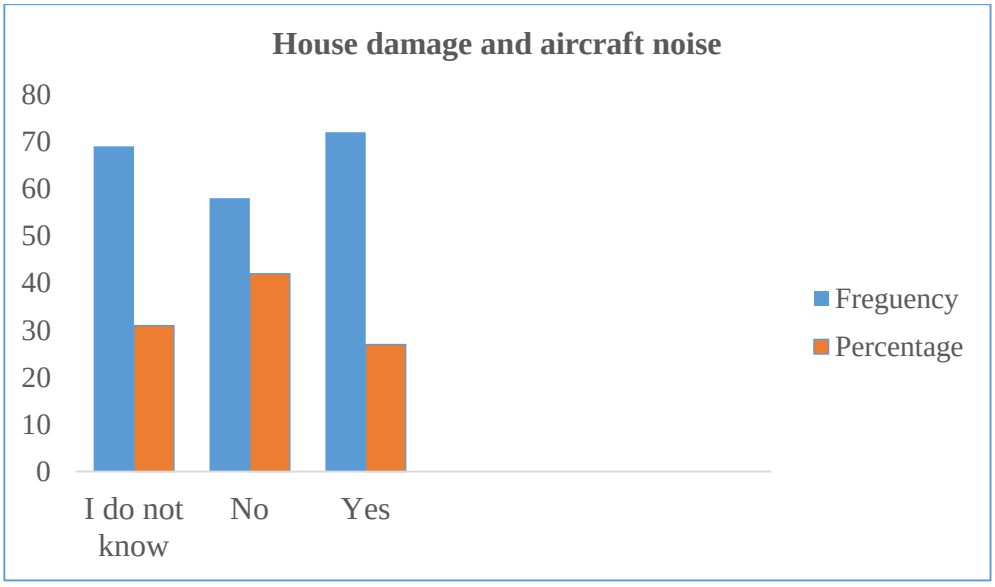

Figure 4.11 House damage and aircraft noise

Figure 4.11 shows that most of the respondents (42%), said they there was no damage to their houses owing to the aircraft operations, while 27% said their houses have been affected. However, 31% of the participants remained neutral.

4.2.4.7 Overall Effect of Aircraft Noise

The respondents were requested to comment on the overall effect of aircraft noise on people who stayed close to the airport. The results are summarized in Table 4.11.

Table 4. 11: Perceived effects of too much noise

Perceived effects of too much noise	**Frequency**	**Percentage (%)**
Noise can interfere with speech and other forms of communication	8	7
Noise can produce physiological stress reactions, which may turn out to have significant long-term health implications.	11	9
Noise can be a significant source of annoyance by disturbing sleep, rest and relaxation.	21	18
Noise can interfere with the performance of complicated tasks.	52	43
Noise can reduce the opportunity for privacy.	10	8
Noise can cause temporary hearing losses, which, if repeated, will result in a chronic loss of hearing.	18	15

Table 4.11 shows that 43% of the respondents stated that noise could interfere with the performance of complicated tasks. This was followed by the effect that noise could be a significant source of frustration by troubling sleep, rest, and relaxation, constituting 18%. In a third position, 15% respondents stated that the effect of noise caused temporary hearing losses, which, if repeated, would result in a chronic loss of hearing. The effect with the least impact, as indicated by only 7% of the respondents, was that the aircraft noise could obstruct a speech and other forms of communication.

4.2.5 Ways of alleviating the Negative Impact of the Location of the Airport: Results from the Residents

4.2.5.1 Coping with Aircraft Noise

The respondents were requested to comment on how they cope with aircraft noise. The results are summarised below on Figure 4.12.

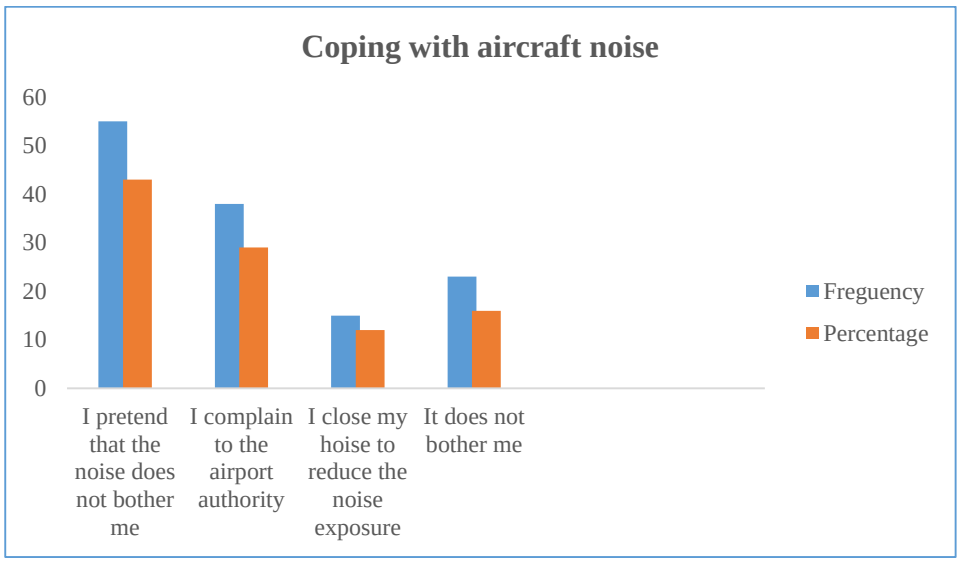

Figure 4.12 Coping with aircraft noise

Figure 4.12 shows that 43% of the participants indicated that the noise did not bother them, while 29% stated that they sometimes complained to the airport authority. The remaining 16 % and 12% chose to close their house doors to reduce the exposure to the noise and not being bothered respectively.

4.3 Qualitative Data Presentation and Analysis

This section analysed data that resulted from semi-structured interviews. As discussed earlier, the interviews were conducted with Property Valuation Namibia officials (PVN, n=2), Estate Agents (EAs, n=2) and Namibia Airport Company (NAC, n=2) officials in order to obtain their professional opinions to support the data outcomes from the quantitative phase of the study. Race in Academia and Pioneer's Park was identified as part of the understanding of the demography in the area. Fifty-nine per cent of residents in these suburbs were of European descent, 6% were people of colour and 35% Africa. All Africa, people of colour and Europeans were interviewed. Qualitative data analysis was divided into the following categories:

4.3.1 Information generated from interviews on residential property values: Results from Estate Agents, and Property Valuators

The table (4.12) below shows that Estate Agents (EAs, n=2), and Property Valuators (PVN, n=2) which were interviewed.

Table 4.12 Biographical Data (N=4)

Codes	Gender	Profile
R1	Male	Property Valuator
R2	Female	Property Valuator
R3	Female	Estate Agent
R4	Female	Estate Agent

Source: Researcher's own design

Respondent from Property Valuation officials and Estate Agents

R1: My understanding is that, on seldom occasions, there are some clients who tend to query about prices of properties closer to the airport. If they request for a discount and we cannot offer them, they sometimes cancel the deal to purchase houses in areas closer to certain noisy zones of the town, which are cheaper.

R2: During my five years in the property industry, I have not come across any case where properties have lost values due to proximity to the airport. In fact, the nature of property, the size of property and its design often affect the pricing more than the location of the property here in Namibia.

R3: My experience is that property buyers tend to consider the architecture of the house and its size more than anything else when checking property values. It is rare to hear buyers unhappy about the proximity of the property to the airport or industrial area. Instead, they usually ask for closeness of schools and shopping services, i.e. amenities.

R4: There appears to be a few relationships between property values and proximity to the airport. In fact, it is all about the quality of the residential property, which determines its value. Most buyers consider how affluent the location is and the size of the land on which it is built.

4.3.2 Information Generated from Interviews on Effects of Aircraft Noise on Social Activities

Table 4.13 shows comments from some (4) residents' from three suburbs were which interviewed.

Table 4.13 Biographical information (N=4)

Codes	Gender	Suburb
R5	Female	Academia
R6	Male	Academia
R7	Male	Pionierspark
R8	Female	Pionierspark

Participants from Academia and Pionierspark suburbs were requested to comment on the effects of aircraft noise on social activities. Responses for four participants are provided below:

Respondent from resident

R5: This noise irritates athletes during competitions such as soccer, netball and tennis. In most cases, players will not hear the umpire's whistles and that disrupts a smooth flow of games. I know of a team, which once lost a match due to aircrafts noise, during a take-off.

R6: I am a social soccer player. Unfortunately, my team uses Academia soccer fields as its home playground for the social league. Now, more often whenever aircrafts either land or take off, the referees usually stop the match until the noise fades off. This causes unnecessary delays in entertaining matche's supporters. I wish they could relocate this airport to the outskirts.

R7: Aircraft noise brings with its annoyance by disturbing our sleep during evenings. This is caused by those landing or flying out early in the morning when we still want to enjoy our sleep especially during cold seasons. Unfortunately, we cannot do anything except having to live with such disturbances.

R8: The Eros airport is a big bother to most of us residents. The irritating noise from aircraft disturbs our rest and relaxation moments. I am already planning to relocate to run away from such noise.

4.3.3 Information Generated from Interviews on the flow line of Aircrafts

The table below (4.14) shows that two (2) officials from NAC comments on questions being asked.

Table 4.14 Biographical information (n=2)

Codes	Gender	Position	Qualifications
R9	**Female**	**Senior**	**Degree (Honors)**
R10	**Male**	**Manager**	**Master Degree**

Respondent from Namibia Airport Company officials

Question: Can you indicate the flow line of aircraft traffic at Eros Airport?

R9: The airport receives an average of 3-4 small sized aircrafts every day and the same number fly out daily from 07:00 am to 20:00 pm. All these aircrafts are for domestic flights and some fly to Cape Town only, while bigger aircrafts use the Hosea Kutako Airport.

R10: The participant indicated that, on average, 21-28 aircrafts landed and flew out of Eros Airport respectively weekly, from 07:00 am to 20:00 pm daily. Air Namibia and Westair have 4 x Embraer ERJ 135 engine are types of aircrafts using the airport together with the private aircrafts. Although the aircrafts were small, the flow of traffic was very high and that amount of noise caused might be unbearable to the residents.

4.3.4 Information Generated from Interviews on Reduction of Aircraft Noise and Noise Pollution: Results from Namibia Airport Company Officials

Question: Is aircraft noise connected with social disadvantages to the neighbourhood? Choose examples from this list:

R9: I would not really say whatever there are social disadvantages in the neighbourhood, because of aircraft noise, but I can say that maybe aircraft noise is responsible for emotional stress, noise pollution, failure to concentrate and poor growth of pets. The respondent indicated that the company was well aware of the dangers of pollution from their aircrafts. The airport company tries hard to mitigate noise levels by using modern technology so that noise does not reach nearby residential properties in its entirety.

R10: I can say there is really noise pollution that may lead to emotional stress and many other ailments, although, Eros Airport only serves two airlines (WestAir and Air Namibia) with two flights per day

respectively. I do not think it is really worse. Since technology has been advancing, the Namibia Airports Company is striving towards mitigating noise pollution generated from aircrafts through engaging its stakeholders.

Question: How does NAC assist its neighbourhood to help them mitigate noise?
R9: The Company is trying all it could to assist in this matter; however, it will not be a one-day thing as there is a lot to take into consideration and various stakeholders such as the airlines operating from the airport and aircraft manufacturers' need to be engaged. From your list, I think residents should install double-pane windows and use others means although that is not a complete solution to the issue of aircraft noise.

R10: The Airport Company also monitors noise pollution levels around the airport using a noise monitoring station located close to the airport. The respondent indicated that the aircraft authorities reduced the level of nuisance generated by a single aircraft through the use of modern technology. This implies that the airport authorities are well aware of the negative effects the aircrafts may pose on the people living in proximity or passing through places closer to the airport.

Table 4.15 Summarised/clusters the themes from the semi-structured interviews

Codes	**Sub-themes**	**Themes**
Architecture Location	House/property searching	Property design is important in determining prices
Soccer Relaxation	Referees Social activities delay	Impact of aircraft noise should be minimized
Innovation	Strategic planning	Innovation and technology advancement is critical in today's business environment
Accountability	Corporate Social Responsibility	Stakeholders engagement is one of a very important aspect of business operation

4.4 Chapter Summary

This chapter has presented the research findings under the following subheadings, generated from the objectives; the impact of noise pollution on residential property values, social and environmental impact of the location of the Eros Airport and ways of alleviating its negative effects. The findings were obtained from interviews conducted with Real Estate Agents, Property Valuators, Residents as well as NAC officials. The study found that property values can be influenced by the design, the location and the size of the property. However, some respondents were unsure of whether the influence of noise significantly affect properties values in the suburbs they reside. Most residents have indicated that aircraft noise disturbs their social gatherings such as soccer to the extent that match official have to pause for aircraft landing or take-off and in the end causing delays to their games. It was also found that aircrafts noise disturbs residents' relaxation time. The study further found that NAC is aware of the issue of aircraft noise and that measures will be put in place in terms of technological advancement.

CHAPTER FIVE: DISCUSSION

5.1 Introduction

This chapter provides a discussion of the research findings presented in Chapter 4. Based on the research objectives as stated in chapter 1, this chapter is divided into two sections: The first section discussed findings from questionnaires while the second section discussed findings from the semi-structured interviews.

5.2 Findings from Questionnaires

5.2 .1 Impact of Aircraft Noise on Residential Property Values

In relation to residential property values, the findings revealed that, although it had happened on a few occasions, some buyers recanted their offer to purchase if denied a discount when purchasing houses in areas close to noisy zones of the town, such as industrial and airport zones. However, based on the findings, the study also revealed that participants believed that there was an uncorrelated relationship between residential property values and proximity to the Eros Airport. However, the estate agents and property evaluators supported this perception by reporting that they had come across on few cases where residential properties had lost value owing to their proximity to the airport. This could be the reason why an overwhelming majority of respondents claimed that there had been no provision for a discount because of the airport noise.

Furthermore, there was unreported and /or unnoticeable damage to houses owing to the aircraft noise. Thus, the estate agents did not see any reason for informing homebuyers about airport operations, thus noise pollution in the suburbs they house in. However, results revealed that property values had been more influenced by three factors such as the architecture, closeness to schools amenities, shopping centres and the size of the property more than the location of the residential property. The findings also revealed that, in addition to the above-mentioned factors, there were three key reasons for selling residential properties in the studied suburbs, which are; high levels of air pollution, failure to service mortgages and an irritating environment predisposed to aircraft noise/noise pollution. Similarly, factors such as distance (being too far) from the CBD, shops and high crime rate were insignificant in causing the falling values of residential properties.

These points were supported by the majority of the respondents who either agreed or strongly agreed that there had been a negative impact on the residential property values close to the airport. This opinion was supported by their argument that they had observed different values in the same type of residential

properties in areas close to the airport such as Academia and Pionierspark compared to others that were a distance away from the Eros Airport where by their prices appeared to be higher. Only a quarter of the residence sample had a different opinion. Additionally, it was revealed that Academia home owners (who happened to be closest to the airport) frequently sold their properties more often than those in Olympia and Pionierspark which were slightly further from the Eros Airport.

Regarding property values, the study revealed that residential property values were lowest in Academia compared with Olympia and Pionierspark, which were slightly further away from the airport. During 2015, property values were averaged at N$3.9 million in Olympia, N$3.2 million in Pionierspark and N$1.8 million in Academia in the same year. However, the general trend was that values of properties had been steadily increasing from 2011 to 2015 for all three residential areas studied. The study has established that the introduction of an airport has both positive and negative effects. These findings are in agreement with Handereka-Gapska and Trojaneck (2013) study, whereby a diagrammatic representation of the positive and negative impact of the introduction an airport in the area were highlighted.

5.2.2 Impact of Aircraft Noise on Recreational Activities within the Vicinity of the Eros Airport

When focusing on the impact of aircraft noise on recreational activities within the vicinity of the Eros Airport, the research revealed that aircraft noise had a negative effect on social events such as sporting activities. The aircraft noise disrupted games and players failed to hear the whistle. Therefore, aircraft noise caused unnecessary delays during matches leading to soccer teams and their supporters complaining about the location of the sport fields. As such, most participants were often annoyed with aircraft noise. According to Nchemanyi (2006), an airport is an unpleasant neighbour because it creates a nuisance that affects property values and sometimes appearance. Furthermore, aircraft noise could interfere with the performance of complicated tasks and could interfere with speech and communication as well as producing physiological stressful reactions especially among school going children thus, leading to a decrease in residential property values. High noise levels can have cardiovascular effects on humans and lead to a high frequency of coronary artery disease. Noise causes a serious threat to a child’s physical and psychological health and can negatively disturb a child's learning and behaviour.

A research conducted by Sukismith and Nitivattananon (2015), at Thailand's Suvarnabhumi Airport on the appliance of a possible growth of reimbursement package, revealed that noise pollution has a larger influence on housing costs than air pollution.

5.2.3 Best possible ways to avoid/minimise negative Impact of Aircraft Noise on the location of the Residential Property Values

Aircraft authorities nowadays are able to reduce the level of noise coming from aeroplanes through adaptive technologies, thereby, minimising the impact of aircraft noise on residential property values. This, in a way, mitigated the negative effects the aircraft had on the people living in proximity or passing through places close to the airport. The airport staff and its management have been aware of the danger posed by aircraft activities on residential properties, indicated by the use of noise-monitoring equipment and a strategic plan on aircraft noise monitoring. Therefore, indicated that noise pollution from the Eros airport is not a new phenomenon. It is something that has been long noted and effort to minimise its impacts are underway. Despite the mitigation efforts, the study revealed that the majority of the respondents would sell their houses and move to quieter areas if such an opportunity arises. However, a sizeable number of respondents indicated that they would stay and live with the noise. The above findings concur with Trojanek *et al.* (2017), who observed that changes in real estate prices are influenced by both general and individual factors. The general factors influencing the property values are, the increase of the population's, disposable income, architecture of the property, closeness of public services and the size of property, while individual factors result from the characteristics of a given kind of land (i.e. property location) including noise pollution as highlighted in this study. Additionally, previous studies on the effects of aircraft on property values revealed that air traffic noise affect negatively on housing costs and that the market value of residential properties is negative affected when properties are located near the airport (Renigier-Bilozor *et al.* 2017; Kopsch, 2016).

5.3 Finding from Semi-Structures Interviews

The discussion for this section of the study was done based on the research objectives as stated in chapter 1 and themes generated as previously indicated in the data analysis of Chapter 3.

5.3.1 Impact of Noise emitted from Aircrafts on Residential Property Values around Eros Airport.

The participants indicated that there were few occasions when they have heard about the need for a discount on the prices of properties closer to the airport. Although it is not often, some buyers cancel their deals if denied such discounts during a purchase of a house in areas closer to certain noisy zones of the town. The participants indicated that they have not yet come across any case where properties had lost values owing to their proximity to the airport. Rather, factors such as the architecture and the size of the property often affected the pricing of properties more than the location of the property in Namibia. The participants reiterated that the architecture of the house and its size affected property values. Buyers

often consider closeness of schools and shopping services as other factors people consider in determining residential property prices. The participants indicated that there was no relationship between residential property values and proximity to the airport. Rather, it was the quality of the residential property, its location and the size of the land, which were the determinants of residential property values. Only few residents consider the aircraft noise.

5.3.2 Effects of aircraft noise on recreational activities within the vicinity of the Eros Airport

The above narrative indicates that aircraft noise has a negative effect on sporting activities. This noise disrupts the smooth flow of games in that players fail to hear the whistle owing to aircraft noise. The above narrative indicates that aircraft noise can force referees to stop the matches until the noise fades. This causes unnecessary delays in matches. This implies that sporting teams and their supporters do not welcome aircraft noise.

Aircraft noise from planes landing and taking off also has a negative effect in that it disturbs people who are sleeping at night and early mornings. This implies that aircraft noise is a menace in the zones located closer to the airport. This narrative implies that aircraft noise disturbs residents' rest and moments of relaxation. Thus, aircraft noise again has been found to have a negative effect on the social events of participants.

5.3.3 Best possible ways to avoid/minimise negative Impact of Aircraft Noise on the location of the Residential Property Values

Worldwide, a lot that has happened in the past is changing due to modern ways of doing business offsetting most of the negative impact towards stakeholders. Businesses has to take risks in investing huge amount of money on technology that would make life easy and comfortable. As respondents indicated, several measures can be implored to deal and mitigate the impact of aircraft noise on the residents of the surrounding areas. It is good that NAC is aware of the issue and that efforts has been made to try and avert the situation although not completely and/or in a blink of an eye yet.

One of the responsibilities of a business is to engage its stakeholders and provide necessary information to them regarding their operation. The company should develop a stakeholder engagement plan in order to sensitize the community in the surrounding area of the airport on issues of aircraft noise when taking

off or landing and sometimes when idling waiting for embarking and departure. This would enable the residents to find ways to reduce the noise and its impact on their lives.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

The Chapter provides concluding remarks of the study in terms of aircraft noise, the surrounding suburbs as well as property values and the overall impact of aircraft noise.

6.2 Conclusion

The research findings revealed two views, namely, one that supports the idea that, there is no relationship between property values and proximity to the airport in the absence of external factors. Those who believe that there are no causal relationships between property values and proximity to the airport argued that they have not yet come across any cases where properties have lost values owing to their proximity to the airport in the studied residential locations. Furthermore, there is no provision for a discount on noise since there is no damage to houses owing to the aircraft operations. Although several responses indicated that, the values of residential properties around the Eros Airport are not influenced by aircraft noise significantly, since residents in studied suburbs are not yet concerned about it. However, other factors including architecture, closeness to schools, shopping services and the size of residential properties were predominant factors impacting on the value of those properties.

The absence of the relationship between airport noise and property values cited above is supported by a study by Pamanikabud and Tansatcha (2009), which revealed that the impact of airports on the residential properties market can be positive. One benefit suggested for living in close proximity to an airport is that it enhances access to those who use the airport frequently.

On the other hand, those who perceive that there is a relationship between property values and proximity to the airport argued that owners sell their properties because of high levels of air pollution, failure to service mortgages and because of the unsuitable environment owing to aircraft noise/noise pollution. These three factors can negatively affect the residential property values close to the airport. Additionally, there are different values of similar residential properties in areas close to the airport such as Academia, Olympia and Pionierspark compared to others, which are a distance away from Eros Airport whereby their prices appear higher. Academia home owners (who happen to be closest to the airport) frequently sell their properties more often than those in Olympia and Pionierspark which is a distance away from the Eros Airport; albeit, property values were lower in Academia compared to Olympia and Pionierspark, which is slightly further away from the airport.

Furthermore, aircraft noise pollution was confirmed to have a negative effect on social events such as sporting activities, rest/leisure and sleep. Children were also affected aircraft noise and noise pollution as they are often agitated, just like adults, because it interferes with the performance of tasks.

Although many previous studies highlighted factors, influencing property values have aimed on the link between of the impact of noise and changes in property values. Apart from the undisputed societal benefits of the sustainable development, this form of air transport also causes anthropogenic amenities. Thus, it is undeniable that a high level of aircraft noise is and will remain a serious problem for people living in the surroundings of airports (both large international airports and local ones). All the study's findings indicate a diminishing value of the social and environment quality thus, can affect residential properties around the studied area.

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APPENDICES

Appendix 1: Research ethics

Research access: All participants in the study were fully informed about the purpose of the study and implications thereof. Letters of consent were requested from the Namibian Airport Company; real estate agents and Property Valuations Namibia, as well as from the City of Windhoek for residents and was submitted to the Higher Degrees Committee (HDC) for the Cape Peninsula University of Technology for approval. The background of the study and the themes that the questions in the interview focused on accompanied requested letters. The letter clarified that the interview was face-to-face and that no part of the interview would be published without the consent of the interviewee.

Observed research ethics: Informed consent: During the request for the interview, the researcher clarified on how the interviews would be conducted. Furthermore, the researcher sought the consent of participants before the interviews. After the authorization for the interview was granted, each interviewee had been interviewed, signed the consent form.

That the interviewee had read and understood the research objectives and themes.

That the interviewee had not been forced by the interviewer during the interview to respond in a particular way;

That the participation of the interviewee had been voluntary and was free;

Another consent form was issued concerning consent to use professional and personal information. The consent form permitted the interviewees to sign off and consent to the following:

The CEOs of companies agreed that the company name could be published in the study as the data source;

That the interviewee agreed or disagreed that their names could be published in the study as a data source;

Or that the interviewee and CEOs of companies agreed or disagreed that the use of anonymous quotes in the public publication of this research could be used;

That the interviewee and CEOs agreed or disagreed that the final draft research report be issued to them for reading prior to public publication to make sure that no harm had been caused to the interviewee and the company they worked for which had provided research data (Greaney *et al*., 2012).

The companies' CEOs and the interviewees were requested to sign the consent letters as described above. However, not all interviewees had signed and returned the consent forms as requested

Anonymity and confidentiality: The researcher additionally guaranteed anonymity and privacy of the research participants.

No harm to the subject: The researcher ensured that the participants were protected from any form of physical or psychological harm.

Confirmability: The researcher ensured that the study results established trustworthiness and incorporated the views of the participants. The researcher also ensured that the study can be replicated. Hence, the researcher ensured that conformability had been achieved and that the findings of the study reflected the opinions of the participants.

Appendix 2: Consent letter Estate Agents & Property Valuation Namibia

Cape Peninsula
University of Technology

Faculty of Applied Science
Environmental and Occupational Studies
Cape Town Campus

Date: 15 June 2017

The Director
Estate Agents & Property Evaluation Namibia
Windhoek
Namibia

Dear Sir/Madam,

Subject: Research request to conduct a questionnaire-based on the residential property values around Eros Airport in Windhoek.

With reference to the subject above,
Selma Nangombe Iipinge, a Masters' student in Environmental Management from the Cape Peninsula University of Technology, request an authorization from your esteemed office, to conduct academic survey, which focused on residential property values. The title of the proposed research study is '**The impact of aircraft noise on residential properties values around Eros Airport in Windhoek, Namibia'**.

The study is being undertaken towards the attainment of the necessities for the enrolled degree. This study aims to identify whether aircraft noise from a commercial airport like Eros Airport affects residential property values. I believe a better understanding of the perceptions of such a phenomenon will also help teal estate agents and Property Valuations Namibia to understand how best to value residential properties. The research reports will be made available to you for your perusal before they can be submitted to my supervisors for marking. The research will be conducted between August and

October 2017 via a questionnaire distributed to your officials. I trust that you will be happy with the above-mentioned. All info will be treated with the highest privacy. Please accept the assurance of my highest consideration in this regard and be at liberty to contact me should there be any clarity required. Your favourable consideration will be highly appreciated.

Sincerely,

……

Ms. Selma Nangombe Iipinge
Principal Researcher
Cape Peninsula University of Technology
Cell: +264812746306

Appendix 3: Participant Declaration

Selma Nangombe Iipinge
Faculty of Applied Science
Environmental and Occupational Studies
Cape Town Campus
sipinge19@gmail.com
Cell: +264 81 2746306

I, Selma Nangombe Iipinge, a Master's student researching '**The impact of aircraft noise on residential property values around Eros Airport in Windhoek, Namibia'**. I herewith would like to request you to partake in the research. Your involvement in this research is voluntary and the researcher will preserve the privacy of all participants in all reporting of this study. The researcher will not reveal the identity or include identifiable characteristics of the participants in the reporting of this study.

If you agree, please sign below.

Name	**Signature:**	**Date**
Participant:		
Researcher:		
Witness:		

Appendix 4: Questionnaire for Estate Agents & Property Valuation Namibia

Cape Peninsula University of Technology

FACULTY OF APPLIED SCIENCE

DEPARTMENT OF ENVIRONMENTAL AND OCCUPATIONAL STUDIES

QUESTIONNAIRE FOR A SURVEY ON:

The impact of aircraft noise on residential property values around Eros Airport in Windhoek, Namibia

QUESTIONNAIRE FOR ESTATE AGENTS & PROPERTY VALUATION NAMIBIA

1. What has been the trend in Erven property values in Olympia over the past five years?

Property values	**2011(N$)**	**2012(N$)**	**2013(N$)**	**2014(N$)**	**2015(N$)**
Highest value					
Lowest value					
Average value					

2. What has been the trend in Erven property values in Academia over the past five years?

Property values	**2011(N$)**	**2012(N$)**	**2013(N$)**	**2014(N$)**	**2015(N$)**
Highest value					
Lowest value					
Average value					

2. **What has been the trend in Erven property values in Pioneerspark over the past five years?**

Property values	**2011 (N$)**	**2012(N$)**	**2013(N$)**	**2014(N$)**	**2015(N$)**
Highest value					
Lowest value					
Average value					

3. **How frequently have people been selling their properties in the following residential zones over the past five years?**

Residential Area	**Very Frequent**	**Frequent**	**Seldom**	**Not Sure**
Olympia				
Academia				
Pioneerspark				
Totals				

4. **Can you pick some of the reasons why property owners have been/are disposing of their properties in the given residential zones?**

Reasons for disposal of properties	**Agree**	**Neutral**	**Disagree**
Irritating environment owing to aircraft noise/noise pollution			
Falling values of residential properties			
Failure to service mortgages			
The need to start up new business using proceeds from property			
High levels of air pollution			
The distance (being far) from CBD and shops			
High crime rate in the area			

6. Are there any negative effect of aircraft noise on the residential property values?

	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Eros Airport has a negative impact on the residential property values					

7. Are there any prospective clients concerned about being exposed to the aircraft noise coming from Eros Airport?

(a) Yes

(b) No

(c)Not sure

8. Do you think about any discount allowed for noise if customers purchase a house close to the airport?

(a) Yes

(b) No

9. Do you openly inform prospective homebuyers about the value of quiet and noise levels of aircraft operations near their residential property of interest?

(a) Yes

(b) No

10. Does Property Valuations Namibia valuate houses close to Eros Airport (Academia and Pionierspark) differently from identical houses that are at a distance from the airport; Kleinkuppe and Olympia?

a) Yes

b) No

c) Not much

If yes, give reasons for your answer

……

……

……..

11. Please give extra information that you think is important with regards to this study or demonstrate extra people whom you think ought to be reached in your country.

……

……

……

Thank you very much for your co-operation, time and assistance in this survey. Should you have any inquiries and extra data, kindly do not hesitate to get in touch with me at +264 81 2746306.

Appendix 5: Consent letter Namibia Airport Company officials

Cape Peninsula
University of Technology

Faculty of Applied Science
Environmental and Occupational Studies
Cape Town Campus
Date: 15 June 2017

Namibia Airport Company
P. O. Box 23061
Windhoek
NAMIBIA

Dear Sir/Madam,

Subject: Request to conduct a questionnaire-based research on the residential property values around Eros Airport in Windhoek.

With reference to the subject above,
Selma Nangombe Iipinge, a Masters' student in Environmental Management from the Cape Peninsula University of Technology, request an authorization from your esteemed office, to conduct academic survey, which focused on residential property values. The title of the proposed enquiry study is **'The impact of aircraft noise on residential property values around Eros Airport in Windhoek, Namibia'.**

The study is being undertaken for the attainment of the necessities for the enrolled degree. This study aims to identify whether aircraft noise from a commercial airport like Eros Airport affects residential property values. I believe a better understanding of the perceptions of such a phenomenon will also help real estate agents and Property Valuations Namibia to clearly understand how best to value and sell residential properties at competitive prices. The research reports will be made available to you for your perusal before they can be submitted to my supervisors for marking. The research will be conducted between August and October 2017 via a questionnaire distributed to your officials. I trust that you will

be happy with the above mentioned. Thank you for your kind understanding in this regard and be at liberty to contact me should there be any clarity required. All info will be preserved with the highest privacy. Your favourable consideration will be highly appreciated.

Sincerely,

…….

Ms Selma Nangombe Iipinge
Principal Researcher
Cape Peninsula University of Technology
Cell: +264812746306

Appendix 6: Questionnaire for Namibia Airport Company

FACULTY OF APPLIED SCIENCE

DEPARTMENT OF ENVIRONMENTAL AND OCCUPATIONAL STUDIES

QUESTIONNAIRE FOR A SURVEY ON:

The impact of aircraft noise on residential property values around Eros Airport in Windhoek, Namibia

QUESTIONNAIRE FOR NAMIBIA AIRPORT COMPANY

1. Can you please indicate the flow line of aircraft traffic at Eros Airport?

……

……

……

2. Is airport noise connected with social disadvantages to the neighbourhood? Choose examples from given list

Social effects	**Tick choice**
Visual impairment	
Air pollution	
Emotional stress	
Weakened body immunity	
Deafness	
Failure to concentrate	
Poor growth of pets	

3. How does NAC assist its neighbourhood to help them mitigate noise?

Ways of mitigating noise	**Tick choice**
Ongoing noise mitigation	
Assessment by noise engineers to decrease the noise level	
Encourage use of double-pane windows	
Encourage use of water fountains	
Encourage background insulation, such as music, etc	
Installing microphones, microprocessors	
Mechanical arms that shut the windows transiently as close by planes take off and land at a close by airport	

4. Please give additional information that you think is significant concerning this survey.

……

……

……

Thank you very much for your co-operation, time and assistance in this survey. Should you have any queries and additional information, please do not hesitate to contact me on +264 81 2746306.

Appendix7: Consent letter for Residents around Eros Airport

Cape Peninsula University of Technology

Faculty of Applied Science
Environment and Occupational Studies
Cape Town Campus, South Africa
Date: 15 June 2017

The Resident
Academia/Pioneer's Park suburb
Windhoek

Dear Sir/Madam,

Subject: Request to conduct a questionnaire-based research on residential property values around Eros Airport in Windhoek.

With reference to the subject above,
Selma Nangombe Iipinge, a Masters' student in Environmental Management from the Cape Peninsula University of Technology, request an authorization from your esteemed office, to conduct academic survey, which focused on residential property values. The title of the proposed research study '**The impact of aircraft noise on residential property values around Eros Airport in Windhoek, Namibia'.** The researcher is researching how aircraft noise impacts on the values of residential property around Eros Airport. Your household has been chosen randomly from your suburb to participate on this research. I would be appreciative on the off chance that you could help with the exploration survey. It seems, by all accounts, to be very long, but since, for most questions, I am searching for a moment reaction instead of a deliberately viewed as one, the entire booklet may just take around 15 to 20 minutes to finish. I would be thankful on the off chance that you could give me your contact number. You will be free not to respond to any question, and you may complete questionnaire whenever you wish. I would be appreciative on the off chance that you could give me your contact number. Please set aside the effort to enable me to assess this fundamental part of prosperity in our locale, for the most part in light of the fact that your reaction is significant. All Information gathered is carefully secret and won't be associated with you in any capacity
Sincerely,
……
Ms. Selma Nangombe Iipinge
Principal Researcher
Cape Peninsula University of Technology
Cell: +264812746306

Appendix 8: Questionnaire for Residents around Eros Airport

FACULTY OF APPLIED SCIENCE

DEPARTMENT OF ENVIRONMENTAL AND OCCUPATIONAL STUDIES

QUESTIONNAIRE FOR A SURVEY ON:

The impacts of aircraft noise on residential property values around Eros Airport in Windhoek, Namibia

QUESTIONNAIRE FOR RESIDENTS

1. How long have you ever lived during this area?

a. 0 to 4 years

b. 5 to 6 years

c. 7 to 8 years

d. 8 to 9 years

e. 10 years and above

2. How many people live in the house?

a. 1 Person

b. 2 Persons

c. 3 Persons

d. 4 Persons

e. More than 4 persons

3. How many children live in the house?

a. 1

b. 2

c. 3

d. 4

e. 5 and above

4. If there are any children in the house, do they complain about aircraft noise?

a. Yes

b. No

5. How often do you feel annoyed when you are exposed to aircraft noise?

a. Never

b. Rarely

c. Occasional

d. Often

e. Very often

6. When you are exposed to aircraft noise, how loud is it?

a. Very quiet

b. Quite quiet?

c. Loud

d. Very loud - leaves a ringing in your ears

7. How do you cope with aircraft noise?

a. I ignore it

b. I complain to the airfield authority

c. I close my house doors to scale back the noise exposure

d. It does not bother me

8. Has any of your neighbours complained about aircraft noise?

a. Yes

b. No

If yes, explain their complaints

……

……

…….

9. Do you think there is any harm to your house because of the aircraft noise?

a. Yes

b. No

c. I do not know

10. If given a choice, would you sell your house and move to a quieter area?

a. Yes

b. No

11. Do you think that aircraft noise can decrease your residential property value?

a. Yes

b. No

If yes, give reasons for your answer

……

……

……

12. From your experience, what are the overall effects of aircraft noise on people who live near the airport?

Perceived effects of too much noise	**Tick choice**
Noise can affect other forms of communication and speech	
Physiological stress reactions, may end up having a significant long-term health implications.	
Noise can be a critical source of irritation, relaxation and sleep disturbance.	
Noise can affect complicated task performance.	
Opportunity of privacy can be reduced by noise	
Noise can cause transitory hearing losses, which, whenever repeated, will bring about a ceaseless loss of hearing.	

……

……

……

13. Please give additional information that you think is important with regards to this survey

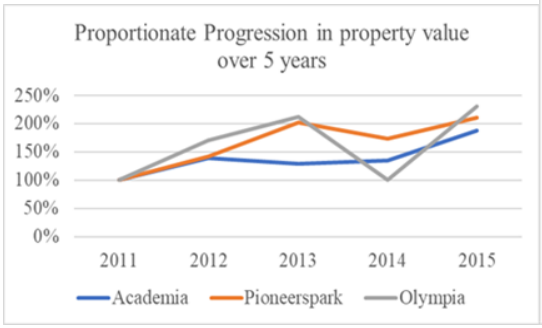
……

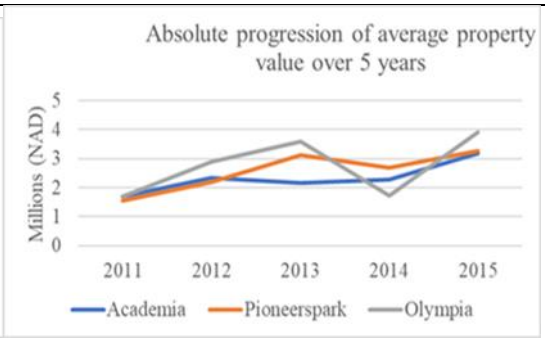
……

……

Thank you for your co-operation, time and assistance in this survey. Should you have any inquiries or additional information, feel free to contact me at +264 81 2746306

Appendix 9: Property Report from FNB Namibia





Land Delivery

Source: FNB 2019 Report

Appendix 10: Original Data Set on the Residential Property Values between 2011 to 2015

Year	Academia Highest	Academia Lowerst	Academia Average	Pionnerspark Highest	Pioneerspark Lowerst	Pioneerspark Average	Olympia Highest	Olympia Lowerst	Olympia Average
2011(N$)	2436700	1250000	1843350	2214500	875000	1544750	NA	NA	NA
2012(N$)	2540000	2150000	2345000	3577000	1000000	2288500	NA	NA	NA
2013(N$)	2978600	1365000	2171800	5850000	1000000	3425000	NA	NA	NA
2014(N$)	2900000	1656500	2278250	3900000	1465000	2682500	1850000	1585000	1717500
2015(N$)	4190000	2345000	3267500	4125000	2200000	3162500	3953200	1885000	3919100

Appendix 11: Calculation and Computation of Standard Deviation for all suburbs

*Calculations***:** *Standard deviation for* ***Academia*** *Average Prices*

$$S=\sqrt{\frac{1}{n-1}\sum\left(X_i-\overline{X}\right)^2}$$

$$=\sqrt{\frac{((1681521-2\ 328\ 814)\text{^}2+(2345000-2\ 328\ 814)\text{^}2+\cdots.+(3167500-2\ 328\ 814^2)}{5-1}}$$

$$=\sqrt{\frac{1130567813000}{4}}$$

=536156

Calculations: Standard deviation for ***Pioneerspark*** *Average Prices*

$$S=\sqrt{\frac{1}{n-1}\sum\left(X_i-\overline{X}\right)^2}$$

$$=\sqrt{\frac{((1544750-2\ 560\ 650)\text{^}2+(2188500-2\ 560\ 650)\text{^}2+\cdots.+(3262500-2\ 560\ 650)}{5-1}}$$

$$=\sqrt{\frac{2,286,720,200,000}{4}}$$

=706484

Calculations: Standard deviation for ***Olympia*** *Average Prices*

$$S=\sqrt{\frac{1}{n-1}\sum\left(X_i-\overline{X}\right)^2}$$

$$=\sqrt{(170000-2\ 767\ 320)\text{^}2+(2900000-2\ 767\ 320)\text{^}2+(\ldots\ldots)+(3919100-2\ 767\ 320)/(5-1)}$$

$$=\sqrt{\frac{11,954,899,148,000.00}{4}}$$

=1034269

Appendix 12: Authorisation letter from City of Windhoek

Department of Human Capital & Corporate Services

59

Corner of 5378 Independence Avenue and Garten Street

WINDHOEK, NAMIBIA

Tel: (+264) 61 290 2911 • Fax: (+264) 61 290 3212 • www.cityofwindhoek.org.na

ENQ:	Mr MA Nikanor	**PHONE:**	09 264 61 290 2630
DATE:	21 February 2018	**FAX:**	09 264 61 290 3212
		EMAIL:	ark@windhoekcc.org.na

RE: PERMISSION TO CONDUCT RESEARCH TITLED "THE IMPACT OF AIRCRAFT NOISE ON RESIDENTIAL PROPERTY VALUES AROUND EROS IN WINDHOEK, NAMIBIA"– SELMA NANGOMBE IIPINGE (STUDENT NO:208115943)

This letter serves as confirmation that Ms. Selma Nangombe Iipinge **(STUDENT NO: 208115943)**, a student pursuing a Master Degree in Environmental Management at the Cape Peninsula University of Technology, has been granted permission to conduct his research on the above subject within the City of Windhoek.

The research, which is in partial fulfilment of the studies, aims to investigate the impacts that affect the residential property values around Eros Airport due to aircraft noise, for many years.

Respondents to the study are therefore requested to render the student their cooperation and assistance. Should there be any queries, please feel free to contact the Human Resources Development Division on the above contact details

Yours Sincerely

MA Nikanor
Manager: Human Resources & Organisational Development

CITY OF WINDHOEK
HUMAN RESOURCES
DEVELOPMENT
2018 -02- 21
NAME: _____
SIGNATURE: _____

Appendix 13: Authorisation letter from Property Valuations Namibia

PROPERTY VALUATIONS NAMIBIA

WINDHOEK OFFICE:
Tel: +264-61-241100
E-Mail: pvnadmin@iway.na

SWAKOPMUND OFFICE:
TEL:+264-64-460002
E-Mail: pvn.coastal@gmail.com

KEETMANSHOOP OFFICE:
TEL: +264-81 142 0831
E-Mail: pvnadmin@iway.na

P.O. Box 81241, Olympia, Windhoek, Namibia

21 February 2018

Cape Peninsula University of Technology
Faculty of Applied Science
Environmental and Occupational Studies
CAPE TOWN

To Whom It May Concern,

RE: PERMISSION TO CONDUCT RESEARCH: MS. SELMA IIPINGE, MASTER'S STUDENT
STUDENT NO: 208115943

The above has reference.

We herewith authorize Ms. Selma Nangombe Iipinge to conduct a research questionnaire at Property Valuations Namibia CC.

For any further information in the above regard, please contact me on 081 124 7434.

With Regards,

.....

P.J. SCHOLTZ
PRINCIPAL VALUER

Appendix 14: Authorisation letter from Namibia Airports Company

Namibia Airports Company Limited
(Registration No. 98/472)
Established in terms of Act 25 of 1998
P.O.Box 23061, Windhoek
154 Independence Avenue
Sanlam Centre, 5th Floor
Tel: +264 61 2955000
Fax: +264 61 2955022
Email: hq@airports.com.na
Website: www.airports.com.na

Enquiries: Mr T Shuungula
Tel : +264 61 295 5581

22 May 2018

MS SELMA NANGOMBE IIPINGE
PRINCIPAL RESEARCHER
CAPE PENINSULA UNIVERSITY OF TECHNOLOGY
TEL. +264 81 274 6306
EMAIL: sipinge19@gmail.com

Dear Ms Iipinge,

RE: REQUEST TO CONDUCT A QUESTIONNAIRE BASED RESEARCH IN THE RESIDENTIAL PROPERTY VALUES AROUND EROS AIRPORT

We refer to your letter dated 19 February 2018 addressed to NAC in respect of the captioned matter.

NAC has taken note of the content of your letter and has the pleasure to inform that your request to conduct the academic research in the manner detailed in your letter has our approval. Furthermore, you are advised to contact the Chief: Safety Officer, Mr. Titus Shuungula based at Eros airport for appointment and/or any other clarification you may require in relation to the research. Mr. Shuungula can be contacted at the following contact details shuungulat@airports.com.na and/or telephone number: 061 295 5581.

We trust the above is in order.

Yours sincerely,

Albertus Aochamub
Chief Executive Officer (Acting)

Directors: Mr Rodgers R.U. Kauta (**Chairperson**), Ms Beverley Gawanas-Vugs (**Deputy Chairperson**), Mr Rudolph R. Rittmann, Ms. Leenda G. Mohamed, Ms. Ipupa Kasheela

Chief Executive Officer (Acting): Mr Albertus Aochamub, **Company Secretary:** Mr. Lot Haihambo

Appendix 15: Research Ethics Committee Letter

Cape Peninsula University of Technology

P.O. Box 1906 • Bellville 7535 South Africa •Tel: +27 21 953 8677 (Bellville), +27 21 460 4213 (Cape Town)

Office of the Chairperson Research Ethics Committee	Faculty of Applied Sciences

The Faculty Research Committee, in consultation with the Chair of the Faculty Ethics Committee, have determined that the research proposal of **SELMA NANGOMBE IIPINGE** for research activities related to the: **M TECH: ENVIRONMENTAL MANAGEMENT** at the Cape Peninsula University of Technology **does require** / does not require ethical clearance.

Proposed title of dissertation/ thesis:	The impact of aircraft noise on residential property values around Eros Airport, Windhoek, Namibia.

Comments (Add any further comments deemed necessary, eg permission required)
Research activities are restricted to those detailed in the research proposal. The research requires ethical clearance due to the questionnaires to be administered including what can be classified as residents/personal information.

Signed: Chairperson: Research Ethics Committee	**Date** 26/04/2018

Appendix 16: Declaration for the professional editing from Dr. Cathy Robertson

DECLARATION

DR CA ROBERTSON

MA (Critical Linguistics *cum laude*), DPhil (Curriculum Studies) (Stellenbosch)

LANGUAGE PRACTITIONER: WRITER, PROOFREADER, LANGUAGE AND ACADEMIC EDITOR

Research Associate: Stellenbosch University
Journal Administrator: JOVACET[1]
Associate Member: Professional Editors' Guild (PEG)

72 Foxglove Street
PAARL
7646

021 872-4404; 082 823 8384
cathy@tcrobertson.co.za

Date: 21 July 2019

Editing of Master's Thesis for Selma Nangombe Iipinge

I confirm that I have edited the following document submitted by Ms Selma Nangombe Iipinge in partial fulfilment of the requirements for the degree of Master of Technology in Environmental Management in the Faculty of Applied Sciences at the Cape Peninsula University of Technology, South Africa.

Research title	*The impact of aircraft noise on residential property values around Eros Airport in Windhoek, Namibia.*
Document type	Master's thesis
Editing services	Editing of chapters 1 – 6: correcting spelling and grammar mistakes; editing for consistency, style and flow; inclusion and accuracy of 74 references, cross-referencing and citations.

The edited document was emailed to Ms Iipinge on Wednesday, 12 June 2019 with all the changes marked up using MSWord's Review (Track Changes). Ms Iipinge is responsible for accepting the editor's changes and finalising the references. S/he is also responsible for the quality and accuracy of the final submission.

Yours faithfully

C A ROBERTSON

[1] Journal of Vocational, Adult and Continuing Education and Training